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NATURAL HISTORY

Nov.-Dec.
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ICELAND PONIES

JOURNAL OF THE AMERICAN
MUSEUM OF NATURAL HISTORY

NEW YORK, N. Y.

THE AMERICAN MUSEUM OF NATURAL HISTORY

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VOLUME XXX
NUMBER 6

NATURAL HISTORY

NOV.-DEC.
1930

The Journal of The American Museum of Natural History

HAWTHORNE DANIEL
Editor

A. KATHERINE BERGER
Associate Editor

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Published bimonthly by The American Museum of Natural History, New York, N. Y. Subscription price $3.00 a year.

Subscriptions should be addressed to James H. Perkins, Treasurer, American Museum of Natural History, 77th St. and Central Park West, New York, N. Y.

NATURAL HISTORY *is sent to all members of the American Museum as one of the privileges of membership.*

Entered as second-class matter April 3, 1919, at the Post Office at New York, New York, under the Act of August 24, 1912.

Acceptance for mailing at special rate of postage provided for in Section 1103 Act of October 3, 1917, authorized on July 15, 1918.

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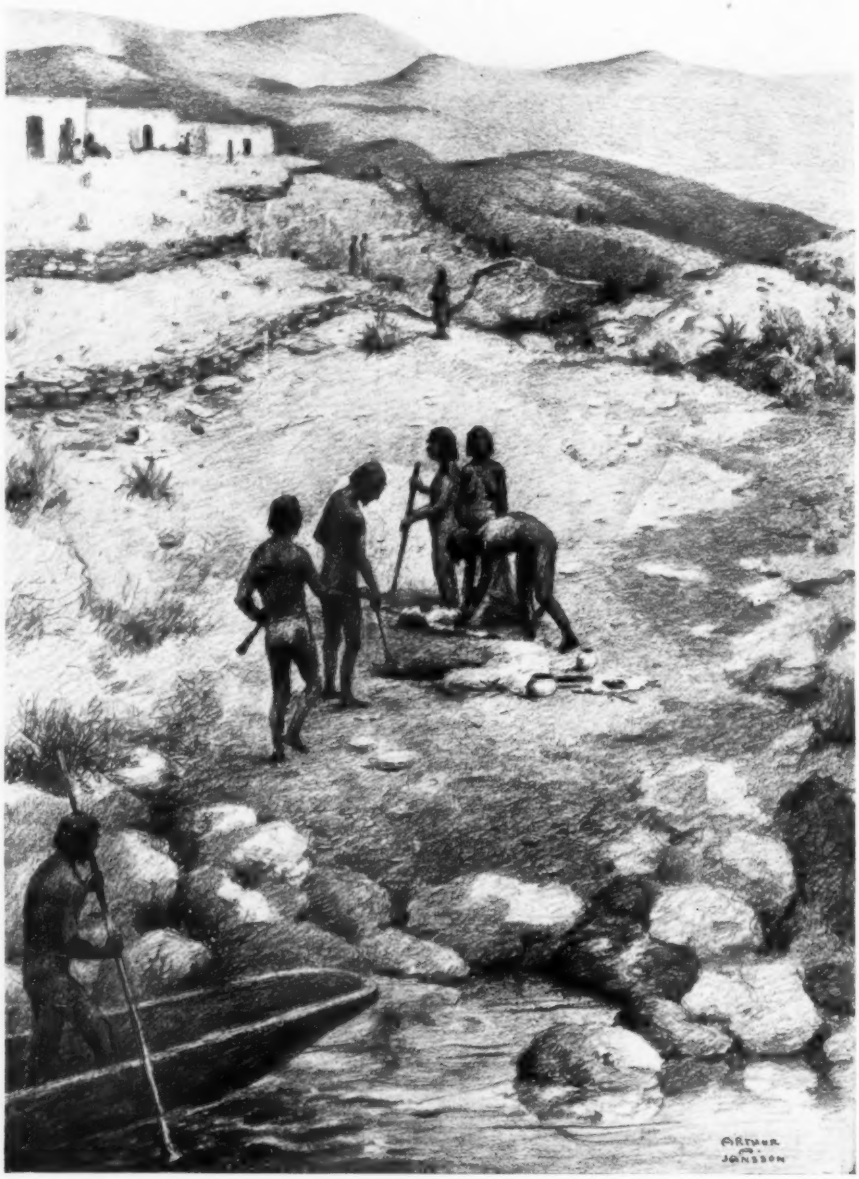


A BURIAL AT PREHISTORIC TICOMAN

The exploration of graves is one of the most rewarding means of discovering the life and habits of forgotten peoples. The simplicity of the burial ceremony at Ticoman shows that the early cultures of the Valley of Mexico could not have had an elaborately ritualistic religion. This picture is a reconstruction by Arthur A. Jansson

(See "Reconstructing the Beginnings of a History," Page 606)

VOLUME XXX

NATURAL HISTORY

NUMBER SIX

NOVEMBER–DECEMBER, 1930

ICELAND

AND ITS ONE-THOUSAND-YEAR OLD PARLIAMENT

The Great Subarctic Island of the North Atlantic Ocean

By CLYDE FISHER

Curator of Visual Instruction in the American Museum of Natural History, and President of the New York Bird and Tree Club

ICELAND is off the beaten track. No steamship line connects this Arctic outpost with America, and consequently it has the lure of the little known,—this in spite of the fact that an Icelander and his followers set foot on our shores nearly five hundred years before the arrival of Columbus.

First settled in 874 by Ingolf of Norway, Iceland later became a dependency of Denmark. In 1874 a millennial celebration of the first settlement was held, opened by King Christian IX of Denmark. Bayard Taylor, attending this ceremony as a correspondent of the *New York Tribune*, has given us a very readable account of it in his *Egypt and Iceland*.

During the last week of June, 1930, another millennial celebration was held in Iceland, this one to mark the founding of the parliament, or Althing, the ceremonies being opened by King Christian X of Denmark and Iceland. When we recall that this legislative body was formed in 930, it makes us feel that our institutions in America are indeed youthful.

Unexpectedly there came to me an opportunity to attend this recent celebration, on a combined mission for the American Museum of Natural History and the New York Bird and Tree Club. For the American Museum I was to gather information and to make photographs for use in our work with the schools of New York City. For the New York Bird and Tree Club it was my mission to present to the government of Iceland a gift of trees in a reforestation project.

Soon after the World War, the New York Bird and Tree Club presented several thousand fruit trees to France, which were planted in devastated areas. This project was so favorably received,—among the letters of appreciation was a memorable one from General Foch,—that the club has been alert for an opportunity to do something of a similar nature in some other corner of the world. After a visit to Iceland a year or two ago, Mrs. Helen B. Norton, one of our members, suggested a gift of one thousand trees

SNÆFELLSJÖKULL
In the western end of Iceland is this beautiful mountain covered with eternal snow, and rising nearly 5000 feet

with a fund to finance the reforestation experiment, and further suggested that the plan be launched at the millennial celebration in 1930. The project was organized and carried to a successful issue by the secretary of the club, Mrs. T. Carlyle Jones.

After careful consideration of the trees that now grow in Iceland, either native or introduced, and after consulting several tree specialists of American botanical gardens and arboretums, as well as expert private nurserymen, it was decided to try several species, among them one or two northern pines, two or three spruces, Canada Balsam, and two northern oaks. During my visit to this sub-arctic island, I examined two plantations of pines, one near Reykjavik, the capital, and one at Thingvellir. These trees had been planted two years ago, but showed not the least signs of winter-injury. In fact, I did not expect to find such evidence, for the climate of this oceanic island laved by the Gulf Stream is not rigorous but surprisingly moderate.

In 1874 Bayard Taylor made the following relevant comment:

> It is a question whether Iceland was ever wooded, as some of the sagas indicate. No large tree-trunks have been found in the peat-beds, and there are no local traditions of woodland. I am convinced that the hardier trees, such as birch, Scotch fir, mountain-ash, and alder, might be raised in sheltered places, with a little care. Yet almost the only tree in Iceland is a mountain-ash, about twenty-five feet high, at Akureyri, on the north coast. Neither temperature nor the prevailing winds are sufficient to prevent the growth of timber; it is more probable that the people never seriously thought of trying the experiment.

Sailing from New York on June 17, 1930, on the S. S. "Polonia," we proceeded directly to Iceland as our first port of call. Our cruise was specially conducted by the Danish American Women's Association under the leadership of Baroness Dahlerup.

Among the passengers, of whom there was an interesting list, was Hon. O. P. B. Jacobsen of Minneapolis, one of President Hoover's five delegates to the millennial celebration. Besides a preliminary shipment of trees, there was on board a bronze bust of Vilhjalmur Stefansson, by the Icelandic sculptress, Nina Saemundsson, a gift to the government of Iceland from the Danish American Women's Association. By vote of Congress, the United States Government presented a bust of Leif Ericson.

With the interest of an all-round naturalist, I was on the look-out for all manifestation of nature from phosphorescent organisms stirred up by the ship to whales that might come near our path; from icebergs to beautiful sunsets. The commonest bird in mid-ocean in the North Atlantic, as has been my experience on previous trips, was the fulmar, a bird that resembles a gull, but which is related to the petrels, shearwaters, and albatrosses. We saw both the light and dark phases. When still nearly two days from Iceland, there came aboard the ship a stone-chat, a small land-bird of the thrush family, which I later saw nesting in Iceland, and which I had previously seen in Arctic Lapland. Near Iceland we saw gannets, murres, great black-back gulls, kittiwakes, and Arctic terns, the last being referred to by the late Prof. Wells W. Cooke as the world's greatest travelers, since many of them nest in the Arctic regions and then go south clear to the Antarctic regions to spend the period of our winter.

On the evening of June 25 we entered the harbor of Reykjavik, the capital of Iceland, and anchored just outside the breakwater. Iceland is almost entirely south of the Arctic Circle, only the northeast corner projecting very slightly beyond.

REYKJAVIK FROM THE HARBOR

Reykjavik, the capital of Iceland, is a thoroughly modern city, equipped with telephones, electric lights, and automobiles

GRYLA, ONE OF THE FAITHFUL GEYSERS OF ICELAND

Besides the hundred or more volcanoes in Iceland there are numerous geysers and small mud volcanoes. The geysers of Iceland were the first ever discovered

Photograph by Hans Peterson

ICELAND PEASANTS AND THEIR HOMES

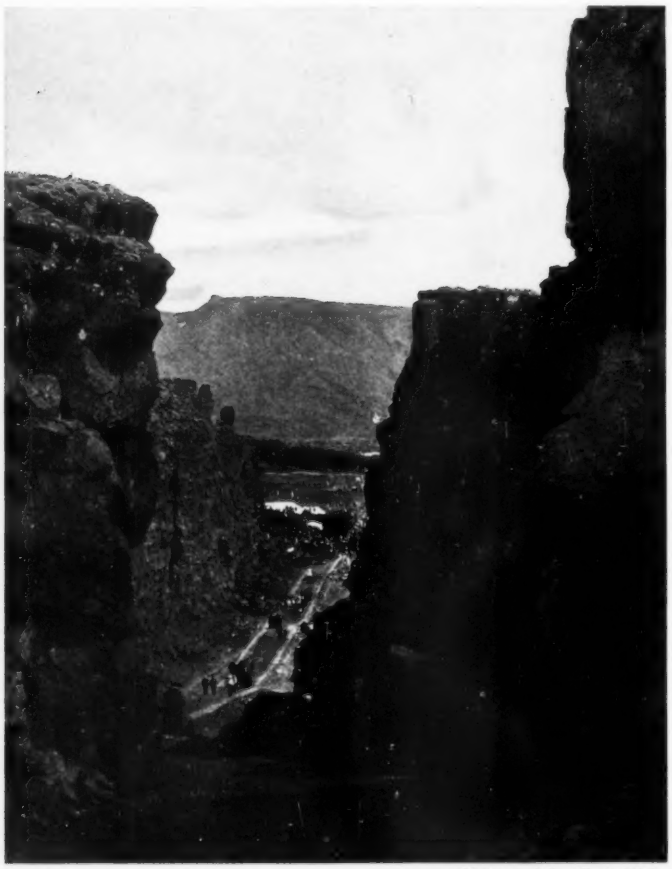
These houses are built of wood, or wood and volcanic rock, and are covered with roofs of grass-covered sod

AN IMPORTANT ICELANDIC INDUSTRY

Most of the fishing is done during the first four or five months of the year, and cod and herring are the principal catch. The chief market for the exported fish is Spain

THE FOREST OF HALLORMSSTAD

On the east coast of Iceland. Some of these northern white birch are said to be nearly forty feet in height



Photograph by Clyde Fisher

ALMANNAGJA OR "THE CHASM OF ALL MEN"
A rift in the volcanic lava leading from the upper plain down to the Law Rock at Thingvellir

The midnight sun can never be seen at Reykjavik, which is located in the southwestern corner of the island. But the northern border of Iceland is so near to the Arctic Circle that the midnight sun can be seen there for about a week, that is, for about three days before and three days after the summer solstice. There are two reasons why the midnight sun can be seen a little way south of the Arctic Circle; first, the sun is not a point, but a disk; and second, on account of refraction by the earth's atmosphere

The name Reykjavik, means "smoky valley" or "smoky bay," and was applied because of the steaming of the hot springs which are in the outskirts of the city. The meaning of this name reminded me of the nickname of Edinburgh, Scotland, "Auld Reekie" (Old Smoky), and I recalled that, although Iceland was settled by early Norwegians, there occurred during the early years an influx of Celts, and I wondered whether the first part of the name, *Reykjavik*, and *Reekie* did not have the same origin. In fact, the name "viking," applied to those early Norsemen who lived on the creeks and fjords of Scandinavia, has the same derivation as the last syllable of "Reykjavik."

It was impressive to see the warships in Reykjavik harbor, namely, English ("Rodney"), Swedish ("Oskar II"), Danish, French, Norwegian, and two belonging to Iceland. The foreign warships had come for the millennial celebration of the founding of the Icelandic parliament. This was our second "white night." In fact, all of our nights in Iceland were "white nights." One feels that it must get dark, but it doesn't. This is difficult to believe even after one has experienced it. We were so near the Arctic Circle that the sun did not set on this date until after eleven o'clock, and of course it rose again soon after midnight.

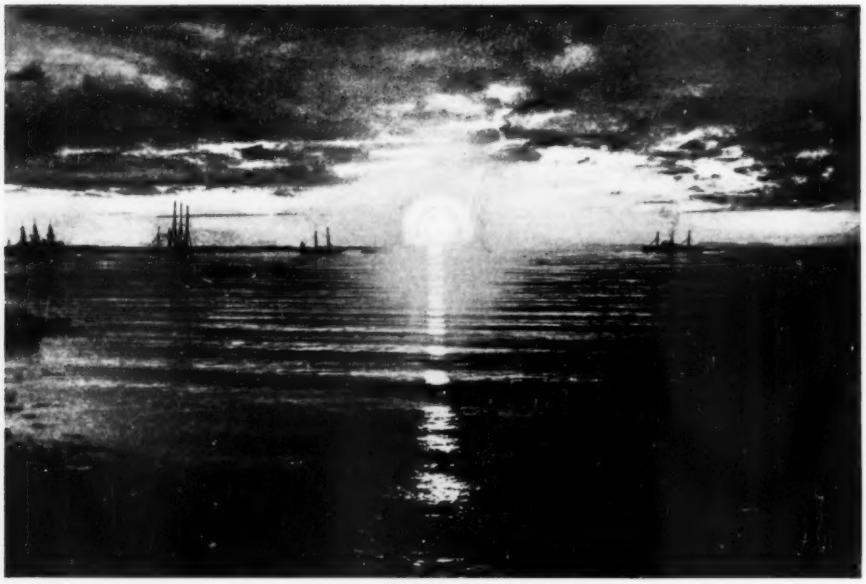
Iceland's volcanic constitution is evident from the harbor. There are a score of volcanoes on the island that have erupted in historic times, but all are quiet now. However, there have been eruptions within the last few years. Hekla

has erupted twenty-two times in the last thousand years. To straighten out any geological problems, I naturally turned to my associate, Mr. Nels C. Nelson, curator of prehistoric archæology in the American Museum, who was a member of our party, and he never disappointed me. Much of the lava is very old, and great grass-covered plains and slopes have derived their soil from decayed larva. One is impressed with the abundance of luxuriant grass. The cultivated grass, or hay fields about Reykjavik were tinged with yellow, as seen from the harbor, due, as I learned later in the evening, to a species of buttercup.

Iceland is about 300 miles long east and west and 200 miles wide north and south, but on account of a very irregular coast-line the area is between 41,000 and 42,000 square miles,—almost exactly the same as the area of Ohio. On account of the abundance of grass in Iceland and the relatively small amount of glacial ice, it has been suggested that it would be much more appropriate if the names of Iceland and Greenland were interchanged.

We went ashore in the life-boats of the ship, and found Reykjavik to be a modern city with telephones, electric lights, and automobiles. However, the street lights were not needed during our stay. The population is about 26,000, including more than one-fourth of all the inhabitants of Iceland. There are an excellent library, a fine cultural museum, and a representative museum of natural history, well housed in one building. There are a university and a museum of sculpture. The latter is noteworthy because it contains only the work of the greatest Icelandic sculptor, Einar Jonsson. The spacious concrete building provides a home and a studio for the artist as well as museum space for the

MILLENNIAL CELEBRATION OF THE FOUNDING OF ICELAND'S PARLIAMENT
It was at Thingvellir, about thirty miles from the present capital of Iceland, that the Icelandic parliament was founded in 930



SUNSET OVER THE HARBOR OF REYKJAVIK

In this harbor warships of many countries anchored during Iceland's millenial celebration

SELJALANDSFOSS

One of the many beautiful waterfalls of Iceland. The man and horse at the foot give an idea of its height

ALFTAVATN OR SWAN LAKE

Near the Sog, not far from Thingvellir. The trees of the so-called forests of Iceland are hardly more than shrubs

ÖXARARFOSS

A waterfall at Thingvellir that lent beauty to the setting for Iceland's millenial celebration

Photograph by Mary Bamberger

ON THE PARLIAMENT'S THOUSANDTH BIRTHDAY

One of the characters in the pageant reënacting the organization of the parliament

display of his work, and it was built by the government. This laudable bit of encouragement is well deserved, for Jonsson's sculpture reflects the very spirit of Iceland. It is strong and original. Especially was I impressed by "The Outlaw," "Remorse," and "Sorrow." One of his pieces, "Thorfinnur Karsefni," the viking who attempted to colonize America in 1007–1011, is in Fairmount Park, Philadelphia. In this connection, I was interested to learn that Thorwaldsen, the great Danish sculptor, was of Icelandic extraction, his father having been an Icelander.

The most important occupation of the people of Iceland is fishing, cod and herring being the principal kinds taken. The chief market for the exported fish is Spain. Dairying is also an important industry. Not only cattle, but also sheep and Iceland ponies are raised. The cattle look like modern European or American breeds, but the Iceland sheep are unique. The scientists have given them a special name, *Ovis brachyura borealis pall.* Both sexes have horns, and the wool, varying in color from white to black, is very long and silky.

The Iceland ponies are most attractive, ranging in color from dun and light gray to dark brown or black, some of them being spotted. They have the most gorgeous manes and forelocks I have ever seen in the horse tribe. The finest specimens, seen head-on, remind one of great maned lions. Some of the manes have a median streak of black bordered by light color, while others have a streak of light color bordered by black. These bi-colored manes are most beautiful.

The Iceland pony, or Celtic horse, as it is known to scientists, is believed by the

AN ICELANDIC GIRL

This colorful national costume with tasseled cap, bodice embroidered in silver and gold, silk apron, and shawl resembling a paisley, is now worn only on special occasions

A LAUNDRY NEAR REYKJAVIK
Water from the hot springs in Iceland is used not only for laundry purposes, but for heating dwellings and greenhouses

best authorities to be the direct descendant of a very hardy northern species which has come down through the ages in an almost pure state, having been changed but little by man's influence. It seems certain that it is more nearly like the first domesticated horses of Europe than any in the world. Those of the prevailing dun color resemble not only in color, but also somewhat in shape, the Mongolian wild horse or Prjevalsky horse. It seems highly probable that this species branched off at an early period from the North African or Arabian stem and spread northward, becoming smaller and more adapted to a severe climate, but retaining many of the Arabian characteristics in anatomy and temperament. It is said that there are 50,000 ponies in Iceland, that is, one for each two human inhabitants. The principal markets outside of Iceland have been the collieries of England and the farms of Denmark.

In the early days, in fact until the Fourteenth Century, horse-fights were considered fine sport in Norway as well as in Iceland. There are lively descriptions in some of the sagas of how the old vikings pitted their stallions one against the other, and of how these horse-fights often led to a bloody feud. In these contests the horses rear up on their hind feet, strike each other with their fore feet, and bite viciously.

Reindeer were introduced into Iceland from Norway in 1771, but they have not been domesticated there as they have been in Lapland. It is estimated that there are now about 700 wild reindeer in Iceland, and they are protected by law.

On the plains of Iceland we saw many interesting birds, among which were curlews, whimbrels, golden plovers, ptarmigan (which turn as white as snow in winter), ravens (so lacking in fear of man that we approached to within a few

yards), wagtails, stone-chats, long-tailed jaeger, oyster-catchers, eider ducks (on a lake), and a thrush whose song resembled that of a veery. The eider duck is carefully protected by law because of the eider-down, the collecting of which constitutes a minor industry in Iceland. I was interested to learn that the last great auk ever seen in any part of the world was killed in 1844 off Cape Reykjanes, southwest of Reykjavik.

A unique sport in Iceland is the peasant-wrestling, or *Glima*, first exhibited to the outside world at the millennial celebration of 1874. This is now included in the Olympic Games, and the champion of *Glima* in Iceland is, of course, champion of the world. Contests were held during the recent millennial celebration, some of which were attended by the King of Iceland and Denmark, who congratulated the victors.

There are many hot springs in Iceland and the people use the water for laundry purposes, as in the outskirts of Reykjavik; for heating dwelling houses, as observed between Reykjavik and Thingvellir; and for heating green-houses in which vegetables and small fruits are grown. The last promises to become an important industry in the island. The name "Geysir" is an original Icelandic word, an onomatopoetic word similar to our word "gusher," and it was first applied to one of the big geysers in Iceland. The name, by extension, has since been applied to the geysers of Yellowstone Park and of New Zealand. The first geysers to be discovered were those in Iceland.

The millennial celebration was held during the three days, June 26, 27, and 28, at Thingvellir, which is located about thirty miles from Reykjavik. It was at Thingvellir that the Icelandic parliament

Photograph by Clyde Fisher

A PLANTATION OF PINES AT THINGVELLIR

They were thriving and unimpaired by the cold of winter. Mr. Bassett Jones, who has had much experience in growing pines in exposed situations, identified these as Swiss mountain pine, (*Pinus montana*)

ICELAND PONIES

The nearest relative of the original domesticated horse of the Old World. They have gorgeous manes and forelocks, and seen head-on, remind one of great maned lions

was founded in 930,—one thousand years ago. The place selected is so unusual that one can easily imagine that he is on the moon or some other planet. The road leading to the Law Rock (Lögberg) passes through a great rift or gorge in the lava. During the three days there was much speech-making on the Law Rock by representatives from many countries of the world. Senator Norbeck spoke for the delegation sent by President Hoover from the United States. Several of our individual states also sent special representatives, among them being Minnesota, Wisconsin, Illinois, North Dakota, South Dakota, and Maryland. This was also true of several provinces of Canada.

Much of the speaking was in the Icelandic language, which is old Norse, changed but very little since the foundation of the government. Immigration has been forbidden, so that outside influences have been almost negligible. It is said that the Iceland people of today can read the sagas of the viking times with greater ease than an Englishman can read Chaucer or Shakespeare.

Several of the representatives from the United States and Canada, being of Icelandic birth or extraction, gave a part or all of their addresses in Icelandic.

Shortly preceding my little speech was one by a representative from Holland. I could not understand at all what he said. I assumed he was speaking in Dutch. Later I sat beside him at luncheon, and I said to him,

"I heard your speech this morning, but not being familiar with Dutch I did not understand it."

He replied, "I am a philologist, and I spoke in Icelandic." I then changed the subject.

No doubt because I had brought a gift to the government of Iceland, I had the honor of being invited to the dinner given

by the Prime Minister to the King. At this function the Queen as well as the ladies of Iceland wore the Icelandic national costume. The waitresses wore a characteristic gray modification of this costume. At this dinner we were cognizant of the repeal of Iceland's prohibition law, under pressure from Spain, who refused to buy Iceland fish unless Iceland bought Spanish wines. The Swedish Crown Prince, Gustaf Adolf, was the only member of Royalty besides the King and Queen of Iceland and Denmark, who was present at the King's dinner and at the entire three days' ceremonies.

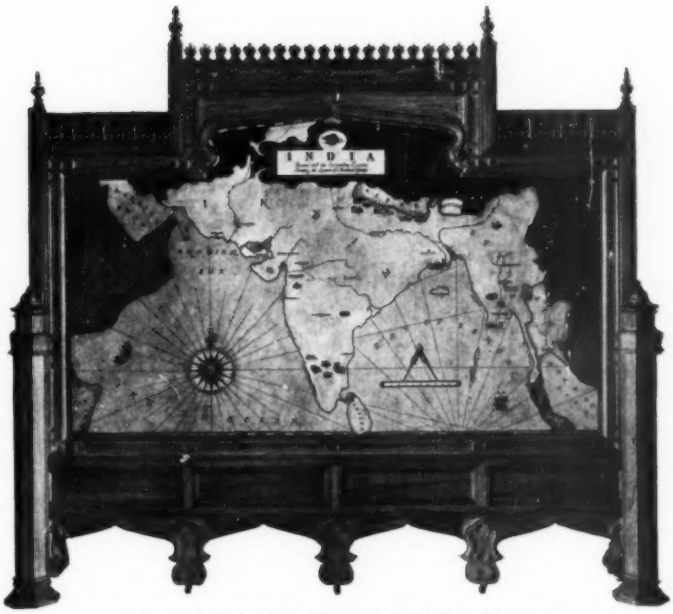
One day during the celebration, in speaking with the Swedish Crown Prince, I reminded him that I had photographed him and his father six years ago at the Royal Palace in Stockholm, and I asked him whether I could photograph him in Iceland. He replied, "Get your camera." When I snapped him he asked the Bishop of Iceland to pose with him. We had a little chat about his visit to the American Museum a few years ago, a visit remembered with pleasure by the members of our scientific staff, because of his pleasant personality and his intelligent interest in a wide range of natural history subjects, especially in archæology. He is a fine, human person.

Iceland shares the King with Denmark. In Denmark they say Christian X is King of Denmark and Iceland; in Iceland they say he is King of Iceland and Denmark. But Iceland pays no taxes to Denmark. The island has its own money, its own postage stamps, its own flag, and its own warships for the protection of its fishing industry.

The strength of character of the Icelandic people impresses one. Their seriousness is probably a result of their environment,—long winters and typical hummock soil of the Arctic prairies. They are progressing in the ways of modern western life by rapid strides.

INGOLF ARNARSON

The first Norwegian colonist of Iceland. Situated on the highest point in Reykjavik is this heroic bronze by Iceland's greatest sculptor, Einar Jonsson



SCREEN AT ENTRANCE TO HALL, WITH MAP TO SHOW WHERE THE GROUPS WERE COLLECTED

SOUTHERN ASIA IN THE AMERICAN MUSEUM

The New Vernay-Faunthorpe Hall of South Asiatic Mammals

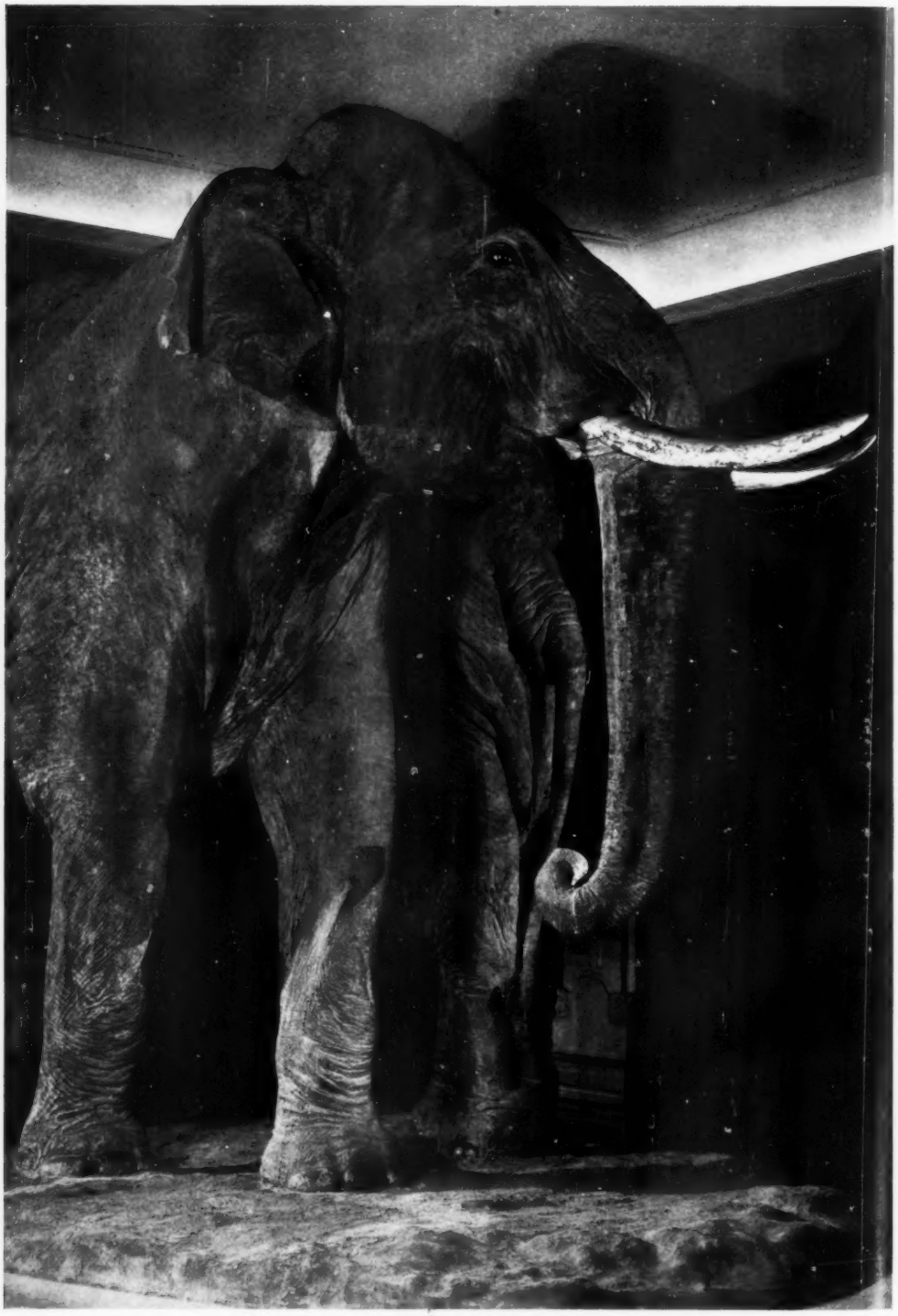
By H. E. ANTHONY
Curator of Mammals, American Museum

Owing to the fact that this article had to go to press while finishing touches were still being added here and there in the new hall, it has not been possible to show in the illustrations all of the groups that were exhibited on the opening night. For the same reason no mention can be made at this time of the details of the official opening to the public on the evening of November 17. An account of the exercises attending the formal presentation of the hall, its acceptance, and the remarks of the speakers will be given in the next number of NATURAL HISTORY.—THE EDITORS.

IN 1918 the late Lt. Col. J. C. Faunthorpe, a member of the British War Mission to the United States, visited the American Museum of Natural History where, to quote his own words, he said (NATURAL HISTORY, March–April, 1924):

> I was much impressed by the perfect system of taxidermy in use and by the artistic manner in which the animals were shown in groups in a reproduction of their natural surroundings, as well as being struck by the fact that the fauna of India were represented by very few specimens, and those of a very poor quality.
>
> Later, on my return to India after a period of duty with the British Embassy at Washington, I wrote to Professor Osborn and offered to make a collection of India animals, if he would provide me with a capable taxidermist. Vernay came to India on a shooting trip shortly after this, and we discussed the matter, with the result that when he returned to America, it was arranged that a collection should be made. The Museum promised us a taxidermist, and Vernay, who not only has ideas but the energy and the means to carry them out, undertook to finance the expedition.

The offer of Colonel Faunthorpe to collect Asiatic mammals for a hall in the projected Southeast Wing was welcomed by President Henry Fairfield Osborn. Early in 1922, when the ideas for the new hall of Asiatic mammals began to crystallize, one of the stumbling blocks in the

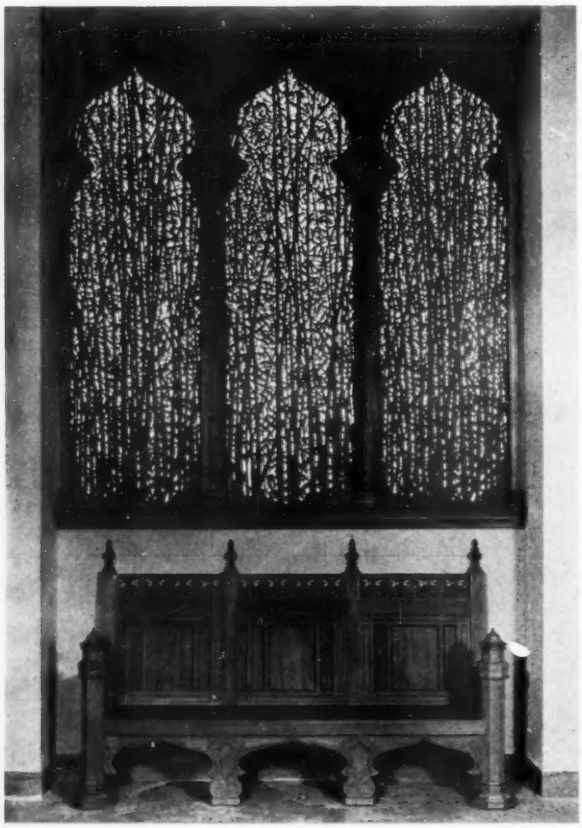


INDIAN ELEPHANTS IN THE CENTER OF THE HALL

Dominating the entire center of the hall is an open group composed of a male and a female Indian elephant. For permission to take these wild specimens in ·uthern Mysore, the Museum is indebted to His Highness the Maharajah of Mysore, G. C. S. I., G. C. I. E., G.B.E.

ARCHITECTURAL DETAILS ABOUT THE MAIN COLUMNS

The ornamentation in the hall is unobtrusive, but the designs have been very carefully selected and executed, and are faithful representations of the older Indian architecture. This photograph was taken before the hall was completed, and the empty case is now occupied by four-horned antelope



A DETAIL OF THE LATERAL ALCOVES
Showing an ornamental bench of teak, and the effective bamboo pattern of the window screens

path of the project was the raising of funds for the field work.

Colonel Faunthorpe had generously donated his services, but transportation and field expenses had to be met, and the outlay involved was considerable. The offer of Mr. Arthur S. Vernay to finance the undertaking removed the last obstacle to consummation of the plans. He not only assumed all of the costs of the collection of the mammals—like Colonel Faunthorpe devoting his personal efforts to the field work—but manifested great interest in every aspect of the plans and contributed substantially toward the expense of mounting specimens after they reached the Museum.

At first the new hall had been intended to contain representative mammals from the entire continent of Asia. When the support of Vernay and Faunthorpe began to be felt, it was obvious that the mammals of southern Asia alone would suffice to fill the hall. In consequence, President Osborn determined to devote the second floor of the new Southeast Wing to the mammals of southern Asia, and on the plans withdrew the mammals of northern or boreal Asia to the adjacent hall of the old Museum wing.

The large mammals of Asia, like those of the other continents, are being rapidly reduced in numbers, and in the case of certain species are practically on the verge of extinction. Indeed, there are a few, such as Schomburgk's deer and the Sonda rhinoceros, which may have completely disappeared. The Indian lion has long been known only from a small number to be found in a very restricted area. If the American Museum was to possess a hall containing any very complete representation of the large mammals of southern Asia, there was no time to be lost.

It was an especially fortunate circumstance for the Museum that the men undertaking the collection of these specimens had such a wide knowledge of conditions in India and adjacent states and were *persona grata* to those individuals best able to aid in the enterprise. Through the influence of Colonel Faunthorpe and Mr. Vernay, the needs of the Museum were brought to the attention of the authorities entrusted with the conservation of the rapidly diminishing species, and exceptional privileges were extended to permit the taking of animals otherwise rigidly

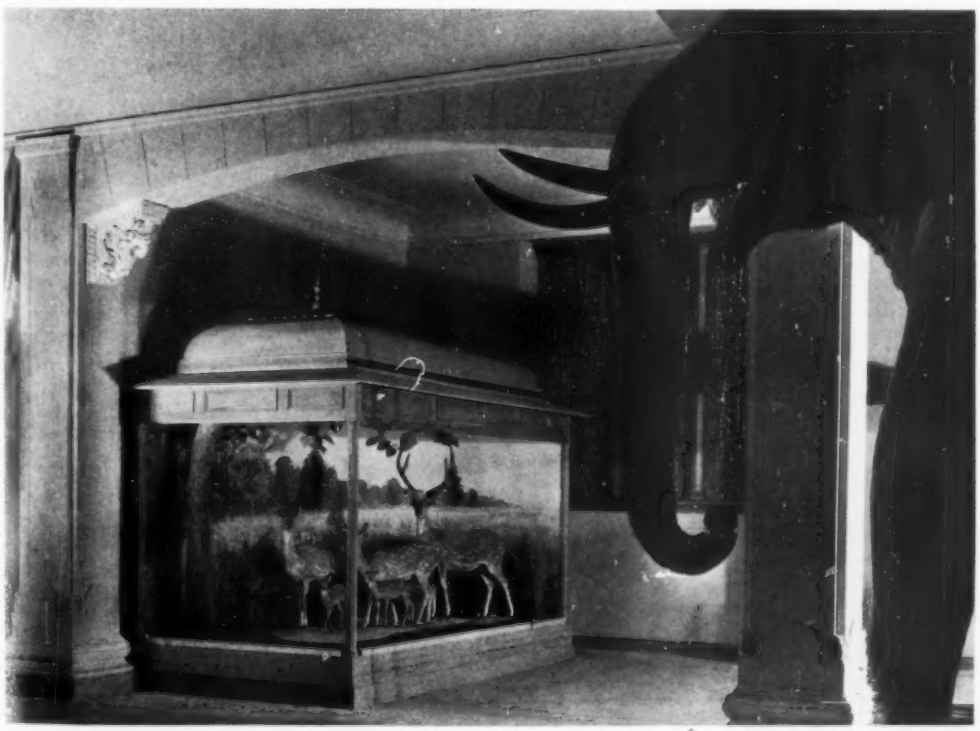
protected. In the years to come the American public will have the opportunity of viewing species which in a short time will have vanished from the face of the earth.

The coöperation which Faunthorpe and Vernay received in southern Asia was the one touch which could alone make or ruin the expeditions. Experienced hunters, and filled with an enthusiastic interest in their project, their efforts would have fallen far short of the success they achieved without the support received from such men as His Excellency the Viceroy Lord Reading, Sir Harcourt Butler, and the Indian Princes, particularly the Maharajah of Mysore, the Maharani of Khairigarh, the Kunwar Dillipat of Khairigarh, the Maharajah of Bikaner, and the Nawab of Junagadh. Apart from this, great assistance was given by the Indian Office, particularly by Sir Malcolm Seton.

The first of the Vernay-Faunthorpe Expeditions began late in the year of 1922 and continued until June, 1923. The field work was remarkably successful, and groups of all the larger mammals of the plains of India, except the buffalo, the Sumatran rhinoceros, and the lion, were obtained.[1] Work was begun on this material soon after it reached the Museum and a part, at least, of the Museum staff of preparators has been continuously engaged since that time upon the multitudinous details connected with the creation of a great hall.

This was the first of a series of expeditions for Asiatic mammals, and either Mr. Vernay or Colonel Faunthorpe, or both, have continued to make long trips into the field to secure groups not hitherto represented, or to replace earlier specimens with better material.

[1]See articles in NATURAL HISTORY March-April, 1924, by J. C. Faunthorpe and Arthur Vernay.



THE CHITAL DEER, ONE OF THE FOUR LESSER HABITAT GROUPS
In harmony with the architecture seen elsewhere in the hall, the cases for these groups have been designed to carry out the Indian motif

THE WATER BUFFALO

There are eight large habitat groups in the hall, and this one of the Indian or water buffalo shows a scene in the Central Provinces. These are the wild representatives of the ox which had been so widely domesticated throughout southern Asia. The water buffalo frequents the lowlands and prefers the vicinity of streams

A PAIR OF LEOPARDS IN SOUTHERN MYSORE

In a *shola* or wooded glen, a leopard has just captured a peacock and the two survivors of the flock are flying off through the trees. Pea fowls are a favorite prey of the leopard. Their presence in the group adds an effective color contrast to the rich markings of the leopards

THE GREAT INDIAN RHINOCEROS

In a thicket of tall grasses near the border of Nepal, a pair of the great Indian one-horned rhinoceroses stand in all the impressiveness of their dermal armor-plate. For permission to take these specimens the Museum is greatly indebted to the late General His Highness Sir Chandra Shumshere Jung Bahadur Rana, G. C. B., G. C. S. I., G. C. M. G., G. C. V. O., D. C. L.

THE BANTING OR TSINE

These wild oxen were taken in Lower Burma, and the dense thicket of bamboo depicts a favorite haunt of this handsome game-mammal. For permission to take these specimens the Museum is greatly indebted to Sir Harcourt Butler, G. C. S. I., G. C. I. E., D. C. L., I. C. S.

SAMBAR DEER AND SWAMP DEER

In a marshy tract in the Tarai, along the foothills of the Himalayas, the sambar deer (left) are grazing close to the swamp deer. For permission to collect these mammals the Museum is greatly indebted to the late Nawab Sultan Jahan, Begum of Bhopal, G. C. S. I., G. C. I. E., C. I., G. B. E., for the sambar, and to Maharani Surat Kunwar, O. B. E., of Kharigarh, Oudh, for the swamp deer

THE STAG AT BAY

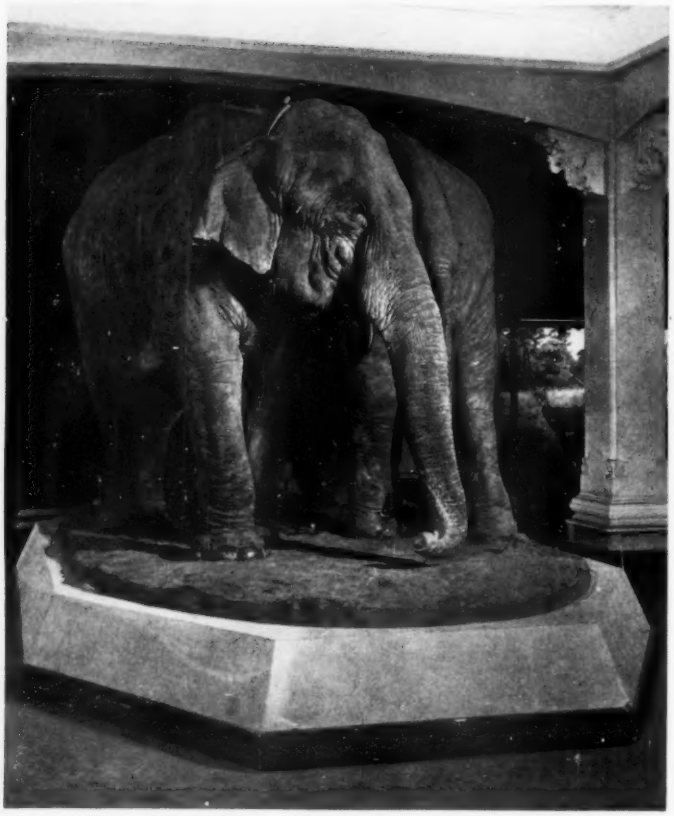
In the Billigirirangan Hills a band of wild dogs have bayed a sambar stag and are grouped about their prey in a dramatic pose

A GROUP OF BENGAL TIGERS

In the Kheri forest a female tiger has just brought her cubs to water at the same moment that a large male appears through the trees attracted to the same stream. For permission to collect these specimens the Museum is greatly indebted to The Most Honourable the Marquess of Reading, P. C., G. C. B., G. C. S. I., G. C. I. E., G. C. V. O., D. C. L., LL.D.

MALE AND FEMALE GAUR

The gaur is one of the most impressive of all the wild oxen. This pair have just come up from a ravine in the Billigirirangan Hills to graze along a grassy ridge

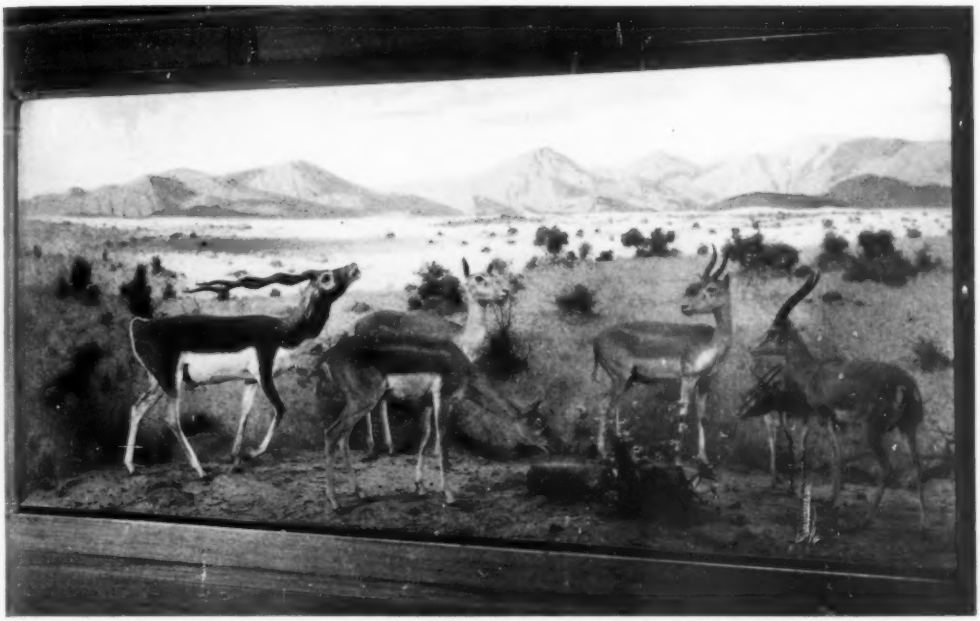


THE GROUP OF INDIAN ELEPHANTS
In this species the tusks of the females are frequently too small to project beyond the margin of the lip

On December 1, 1929, Colonel Faunthorpe died of pneumonia, at Lucknow, India, without having seen the great progress made during that year upon the material he had been so earnestly gathering. His passing was a great loss to the Museum, and it was one of the ironies of fate that he should be taken just as the hall was entering upon the final stages of completion and assuming a grandeur of character and proportion which justified his early faith and vision.

The most productive expedition, in many respects, was that of 1927–28, when Mr. Vernay took two members of the Museum department of preparation, A. E. Butler, assistant chief of the department, who collected accessory material, and Clarence C. Rosenkranz, an artist, to make background studies. This material, and the experience gained by the preparators, added greatly to the value of the specimens collected previously, for it now became possible to build background habitat groups in accordance with best modern practise. The major groups in this hall are now all based upon careful paintings of actual localities chosen, both because they were the natural habitats of the species to be exhibited, and because they illustrate an important type of topography or ecological area. The vegetation is the actual plant life collected on the spot or a facsimile copy in certain cases where preservation was impossible.

In all, some six expeditions have been necessary to assemble the field materials for the Vernay-Faunthorpe Hall of South Asiatic Mammals. The transformation of these, from hard hides, dried plants, and small canvases into lifelike animals, growing vegetation, and expansive vistas, has been an enormous task and one calling for all the artistry and ability of Mr. James L. Clark, assistant director, in charge of preparation, and of his staff. He has had as an ideal the exhibition of groups that are biologically sound, that show the mammals as they are best known to competent observers, and that will convince the visitor that he is looking upon a transported bit of Asia. Having taken into consideration every known



BLACK BUCK AND INDIAN GAZELLE

On the sunlit Nasik Plains a small group of black buck (left), escorted by a strutting male, encounter a small band of Indian gazelles. For permission to collect these specimens of Indian gazelles the Museum is greatly indebted to Major-General His Highness the Maharajah of Bikanir, G. C. S. I., G. C. I. E., G. C. V. O., G. B. E., A. D. C., LL.D.

THE CHITAL OR AXIS DEER

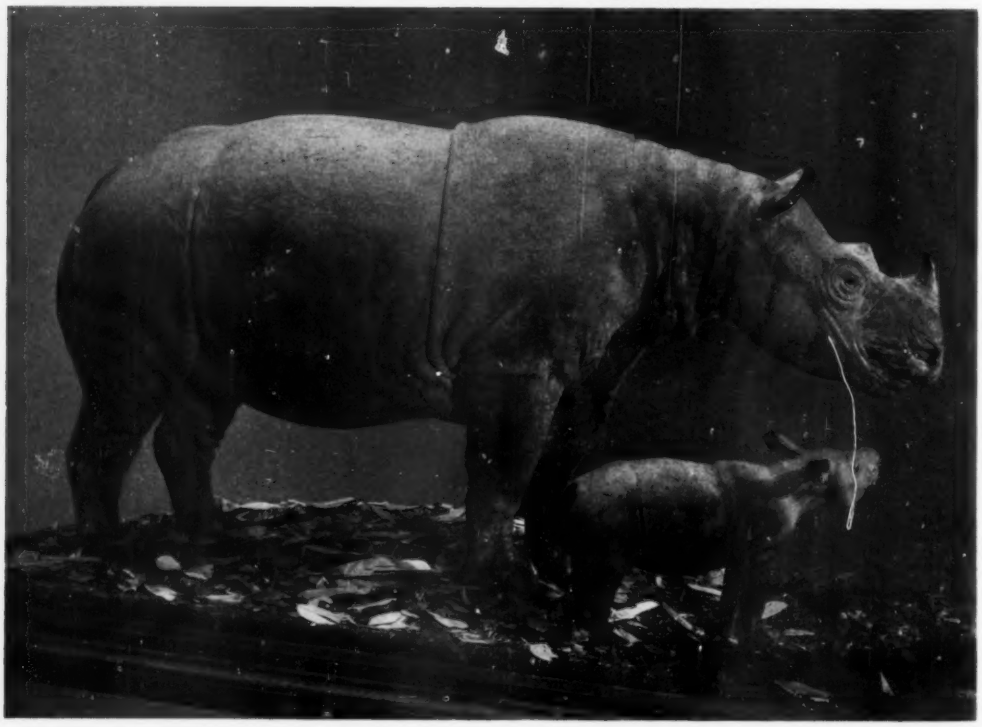
In the Province of Khairigarh a beautiful group of this handsomely marked deer are crossing a park-like opening in the forest. For permission to collect these specimens the Museum is greatly indebted to Maharani Surat Kunwar, O. B. E., of Kharigarh, Oudh

A FAMILY GROUP OF SLOTH BEARS

The sloth bear is of surly and uncertain temperament, more aggressive than the other species of small bears. This group is prowling about a termite nest near the Nepal border

SUMATRAN RHINOCEROS WITH YOUNG

One of the open groups in the eastern alcove displays these smallest of the species of rhinoceroses which was collected in Lower Burma. For permission to take these specimens the Museum is greatly indebted to Sir Harcourt Butler, G. C. S. I., G. C. I. E., D. C. L., I. C. S.

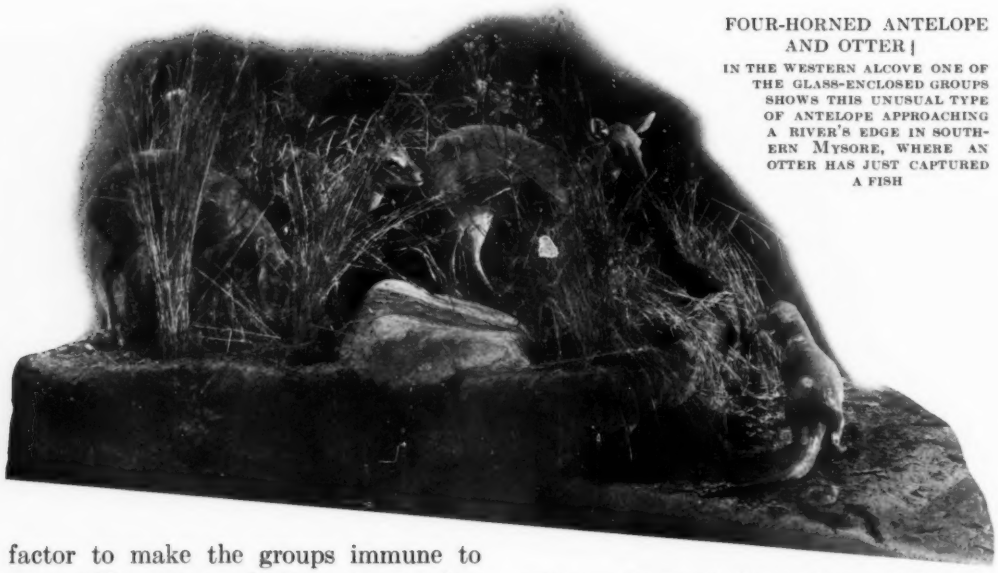


A PAIR OF THE RARE INDIAN LIONS

To many it will be news that the lion occurs in Asia, and as a matter of fact it is almost extinct there. These specimens were taken at Junagarh, Bombay Presidency, and for permission to collect this valuable pair of a fast disappearing species, the Museum is greatly indebted to His Highness Sir Mahabat Khan, K. C. S. I., Nawab of Jungadh

THE NILGAI OR BLUE BUCK

This is the largest of the Indian antelopes and stands in a glass-enclosed case in the center of the hall



FOUR-HORNED ANTELOPE AND OTTER

IN THE WESTERN ALCOVE ONE OF THE GLASS-ENCLOSED GROUPS SHOWS THIS UNUSUAL TYPE OF ANTELOPE APPROACHING A RIVER'S EDGE IN SOUTHERN MYSORE, WHERE AN OTTER HAS JUST CAPTURED A FISH

factor to make the groups immune to reasonable criticism, he has attempted to treat the hall as a whole in such a manner that the Indian motif will be carried out by architectural details and the decorations of case-fronts, pillars, benches, windows, etc.

The success of this idea is apparent the moment one enters the hall. The light from the windows filtering through thickets of bamboo, the employment of teak wherever wood is used throughout the hall, and the suggestive Indian designs, all help to create an atmosphere that is in harmony with the mammals the visitor expects to see. Two large teak screens and two benches, richly carved and figured, were designed and executed by Arthur S. Vernay, Inc., and donated to the hall by Mr. Vernay personally. They add greatly to the attractiveness of the hall.

The general plan of the new Vernay-Faunthorpe Hall of South Asiatic Mammals provides for an adequate display of all of the dominant mammal types to be found in the region lying between the Himalayas and the islands south of the Malay Peninsula. Even in a hall of this size it would be impossible properly to exhibit specimens of all the distinct species—the South Asiatic fauna is far too large—but the selection includes the mammals which will be of the greatest interest to most visitors.

Long experience with the problems of daylight illumination has demonstrated the undesirability of sunlight in halls containing natural history material. Colors are soon faded, light values are continually varying, and illumination from outside the groups introduces troublesome reflections on the glass case-fronts. Therefore, the generally accepted ideal is a hall where groups are illuminated by electric lights from within and where the only sunlight admitted is a controlled minimum for certain limited areas. In the Vernay-Faunthorpe Hall of South Asiatic Mammals the large groups are handled as individual concepts entirely distinct from anything else in the hall. They have independent lighting, and no intrusive details are permitted to work against the creation of an illusion which will transport the visitor into the heart of India.

The biological data to be demonstrated by the group have naturally been given the first consideration, but other factors have been allowed to enter into the plans,

and it is hoped that the new hall may serve to give instruction in fields other than zoölogical. For example, the topographic and geological features shown are all based upon careful field studies; the same may be said of the botanical details, and the architectural designs are faithful to the older Indian culture. The labels accompanying each group have been written to point out the most salient habits or to satisfy the questions most likely to be asked about the species in question. Special discussion of topics which involve biological principles more or less common to mammals throughout the world is reserved for the labels in the Synoptic Hall of Mammals.

There are certain factors which govern the planning of life-history groups such as are exhibited in the new hall. The general public has shown that it is partial to a group which features male, female, and young; the sportsman views a group with a critical eye and judges the animals first as to size, whether the specimen is as large as one he has killed (usually it is not!), and whether the action shows the species as he has found it in his personal experience; and a very limited number of visitors will weigh the exhibit in the light of what it shows to the specialist, what it tells or fails to tell of fundamental biological principles. Not all of these various visitors can be satisfied; no single group will meet all of these requirements.

Southern Asia has an extensive and interesting mammal fauna. A family group of any of the large species will prove eminently satisfying to the average visitor, for the specimens and habitat differ strikingly from his local associations. Such a group will answer graphically the greatest number of questions which might

THAMIN OR ELD'S DEER

Near Taungdwingyi, in Lower Burma, a handsome buck, with his harem, is shown in a region of open shrubbery. For permission to collect these specimens the Museum is greatly indebted to Sir Harcourt Butler, G. C. S. I., G. C. I. E., D. C. L., I. C. S.

arise, and will direct attention to the most salient features, such as color or size differences between sexes, sex-linked characters like horns or antlers, and the many varied details which are centered about the most important season of mammalian existence. It is not always easy to collect the material for a group of this type, for sometimes young of the desired age are difficult to secure. The intimate details of the family life of many species are only imperfectly known, and in building the group nothing can be taken for granted.

As one enters the Vernay-Faunthorpe Hall of South Asiatic Mammals, through the J. A. Allen Hall of North American Mammals and the projected Hall of North Asiatic Mammals, the first bit of India to meet the eye is a tiger-hunting scene copied upon a large screen. This illustration was taken from an old sporting print. From the entrance to the new hall the visitor notes a spacious passageway guarded near the southern end by a pair of lions and dominated throughout the central section by two Indian elephants upon which a subdued light pours from overhead. Flanking the wide passageway are four large case-fronts at either end, two on a side, and through the nearest of these windows one glimpses the environs of another world.

Beyond the threshold of the hall the spectator enters Southern Asia and he needs no great amount of imagination to be convinced of this fact.

SCREEN AT ENTRANCE TO HALL, WITH COPY OF OLD SPORTING PRINT OF TIGER HUNT

ABOVE AND BELOW BAHAMAN WATERS

An American Museum Expedition in the West Indies

By ROY WALDO MINER
Curator of Marine Life, American Museum

THE "Escape" gingerly worked her way out from Sands's dock between the mooring hawser of a huge scow and the bowsprit of a native sponger. Johnson, standing on the bow with boat-hook poised, his mahogany profile intent, fended us expertly away from the white sides and shining brass work of a yacht tied to the end of the pier. Swinging to the left, we gathered speed and cut across the basin past the end of St. George's wharf out into the open waters of the harbor. We skirted the miscellaneous shipping of Nassau's picturesque water-front and passed low sheds with long rows of assorted sponges spread out on palmetto fronds. Now we were opposite the fruit and vegetable market, and could see tables piled high with melons, oranges, tomatoes, and limes from the "out islands," around which crowded white-clad figures of both whites and natives intent upon buying and selling. We drew rapidly away from the shore, heading westward with the harbor entrance at our right, guarded by Hog Island Light, standing like a white sentinel against the deep blue of the northern sky and the still deeper blue of the Atlantic. The waves surged against the dangerous rocks at the point and sent clouds of snowy spray halfway up the sides of the light-tower.

Commodore Daniel Bacon, our host, held the wheel steady with one hand and turned toward us where we sat in the cockpit.

"That's what last October's hurricane did to the 'Princess Montague,'" he said, pointing toward a large steam-vessel, wrecked and canted at a sharp angle, where she lay firmly lodged on a dangerous-looking reef. "We always give Tony's Reef a wide berth," he added, suiting the action to the word. As we circled about, the swell from the harbor entrance gave the "Escape" a few minutes of busy tossing, but her twin screws gathered speed and we slid onward behind the shelter of Silver Cay and headed for an island beyond, where a few small bungalows snuggled among the shrubbery on its rounded summit. Mrs. Bacon rose from her seat beside my wife and, balancing herself precariously on the cockpit bench, leveled a pair of field glasses at the group of buildings.

"There's Fred watching for us on the veranda. I hope he has luncheon ready." She turned toward us. "It's too bad to have to bring you to 'Pirate's Nest' with the island in so sad a condition."

Tony Work, sitting beside me with one knee hunched up under his chin, surveyed the island thoughtfully.

"If you could have seen it before the hurricane, you would certainly never recognise it now," he remarked.

Truly the effects of the recent storm were everywhere apparent. Damages to the buildings had been repaired, but instead of nestling in a bower of coconut palms, casuarian pines, and blooming tropical shrubbery, they stood out naked and bare among the stumps of the twisted coconuts, from the tops of which a few irregular leaf-clusters were struggling to hold their own. The whole crest

of the island was a mass of tangled shrubbery, but seared and brown as though it had passed through a northern winter. In fact, the feeling of early spring was heightened by the green leaf-buds which were showing everywhere, but not sufficiently developed to hide the brown lacework of branches beneath. A few irregular and bent pipelike supports were all that remained of the long wharf. So we had to anchor off-shore and land on a narrow sandy beach, with the aid of the dinghy. The beach projected, spitlike, from the bottom of the low cliff which bounded the entire island.

We clambered over the jagged pinnacles of the eroded limestone to a narrow path that wound through the otherwise impenetrable thicket and emerged into a clearing partially surrounded by rough stone walls where, at the summit of the island, a hospitable single-storied bungalow overlooked the harbor. Other buildings — guest bungalow, kitchen, and servants' quarters, together with a boathouse on the rocks at the water's edge, completed the group. Our hosts made us heartily welcome in the cheerful living room of the main bungalow where Fred had spread a delicious luncheon for us. When our appetites had been appeased and we had sufficiently admired the wonderful panorama of the open Atlantic, we started to explore the island.

The American Museum of Natural History had sent me to the Bahamas to continue field work in connection with the coral reef exhibit now being built in the Hall of Ocean Life, and my wife, who is expert in swimming and diving, had volunteered to assist me in that part of the work. We had been invited by the Bacons to make "Pirate's Nest" our headquarters during the month of March, while we were in the neighborhood of Nassau. Early in April I was to join forces with Dr. Charles Fish of the Buffalo Museum of Science to take part in an expedition to the sponge banks of Andros Island, conducted by Professor Field of Princeton University. During the latter part of that month I was to return to

THE "MARMION," EN ROUTE TO ROSE ISLAND

The ketch "Marmion" owned and navigated by Mr. Hugh Matheson of Coconut Grove, Florida, was the headquarters boat during the sea-diving operations at Rose Island, east of Nassau

AN ISLAND OF PETRIFIED SAND DUNES

Long Cay or "Pirate's Nest," near Nassau, is composed of æolian limestone, that is, rock formed from wind-blown limy sands. Wave erosion has exposed the layers of the limestone rock thus formed

Nassau to study the reef at Rose Island with the aid of diving helmets.

Mr. Bacon's island is down on the Admiralty Charts as Long Cay, but he has renamed it "Pirate's Nest" because of legends of buried treasure which still linger about the place. In this respect, however, it is no exception, for such tales cling to all parts of the Bahamas, dating from the days when pirate vessels lurked about the archipelago, preying upon the commerce of the Spanish Main and seeking refuge from the pursuing vessels of His Britannic Majesty behind dangerous coral reefs and in secret waterways and harbors.

The island is interesting from a geological viewpoint. It rises evenly in a long hog-back, about one-half mile in length, and is entirely of æolian limestone; that is, the rock composing it is compacted of wind-blown limy sands. These sands originated from the broken up and finely ground fragments of corals, mollusk shells, and skeletons of microscopic protozoa. A portion of the lime from these sources is also dissolved in sea water and redeposited in solid form. Sands, thus made, are blown about by the winds and heaped up in dunes, often forming islands in which vegetation takes root and acts as holdfasts. A certain amount of carbon dioxide is always absorbed from the atmosphere by rainwater and renders it acid enough to dissolve the limy sands and become saturated with lime in solution. Under the heat of the tropical sun, the water is rapidly evaporated and, the burden of lime being redeposited, cements the sand into limestone, a process which is hastened by the pressure of succeeding layers.

The rock of Pirate's Nest was produced in this way, but forces now acting upon it tend to its destruction. The surf of the Atlantic thunders on its northern side, rushing up the hog-back in powerful surges. The action of the waves fractures the rock and, separating the layers, removes it in flat sections, due to its stratified condition. Sometimes the whole crown of a petrified dune will be removed, leaving the broken edges of the strata

surrounding the cavity like an amphitheater. The tropical rains, rushing down in torrents on the rocky surface, dissolve it, forming circular solution pits which are deepened and permeate the rock like the holes in Swiss cheese. These cavities render the rock more fragile and give the waves a greater purchase, thus hastening the process of disintegration. The pits in the higher regions of the shore become pools of rain water after every storm. The water, being supersaturated with lime, evaporates rapidly and redeposits the lime on the bottom and sides of the pit, where it overspreads its irregularities like a smooth blanket. Oftentimes, fragments of coral heads are tossed on the rocky shore by the waves and are cemented solidly to the under-lying rock by redeposited lime, but additions of this kind are not sufficient to balance the disintegrating forces. The western end of the island shows the most advanced state of destruction. Here the rock has been brought close to the level of the waves, which, in fact, have overwhelmed it at certain points, thus separating the island from its westernmost tip. As the tide rises, the surf comes rushing and boiling across this low portion, disintegrating it, and spreading its ground-up fragments over the sea bottom on the harbor side of the island. The shallow sand-flat formed in this way is partly sheltered at low water and here grow great quantities of gorgonians, i.e., sea-feathers, sea-fans, sea-plumes, sea-bushes, "monkey-tails," and sea-whips.

All these forms are very abundant on the coral reefs and this sheltered flat is a very convenient place for collecting them rapidly and in quantity. They are identical with the growth forms on the submerged reefs, except that the largest specimens are not present. We needed numerous specimens for our Museum group and therefore made this our first collecting locality. Our method was simple. We waded out as far as possible at low tide and, submerging ourselves in the water, wrenched the specimens from the coral fragments to which they were attached, taking care not to injure them. Many beautiful growths were secured in this way.

EXAMINING A SEA-FAN FISHED UP NEAR "PIRATE'S NEST"

Mr. and Mrs. Daniel Bacon, at their winter camp, "Pirate's Nest," near Nassau

The gorgonians are a kind of coral growth which forms a core of horny, flexible material instead of laying down a hard skeleton of carbonate of lime, as in the case of stony corals. This structure branches and sub-branches, in some species, sparsely, in others, to a very fine degree. The interior of the trunk and branches is constructed of tough black horn, with the elasticity of coach-whips. In fact, the core of large specimens is often used for this purpose by the Ba-

haman natives; hence the name, sea-whip. Outside this tough core is a more or less fragile crust, or cortex, with many pin-hole perforations, a felted layer made up of myriads of minute needles, or spicules, of carbonate of lime. Seen under a microscope, the spicules look like shining, transparent oat grains, except that they are covered with tiny knobs and are often irregularly branched. They have a characteristic range of form and color for each species, and therefore are useful in species determination. The cortex of spicules is held together by a cementing substance and by the tissues of the gorgonian animal. It is easily separated from the tough inner core, and tends to break off in sections in a dried specimen. The animals that build this branching skeleton are polyps, like those that form coral. A sea-bush on the ocean bottom, when fully expanded, is seen to be covered with them, each tiny individual protruding from one of the pin-holes in the cortex, expanding its petal-like circlet of eight fern-shaped tentacles surrounding a central mouth, on the end of the tubular body.

LIMESTONE-COVERED PLANT ROOTS OF A BYGONE SANDY BEACH

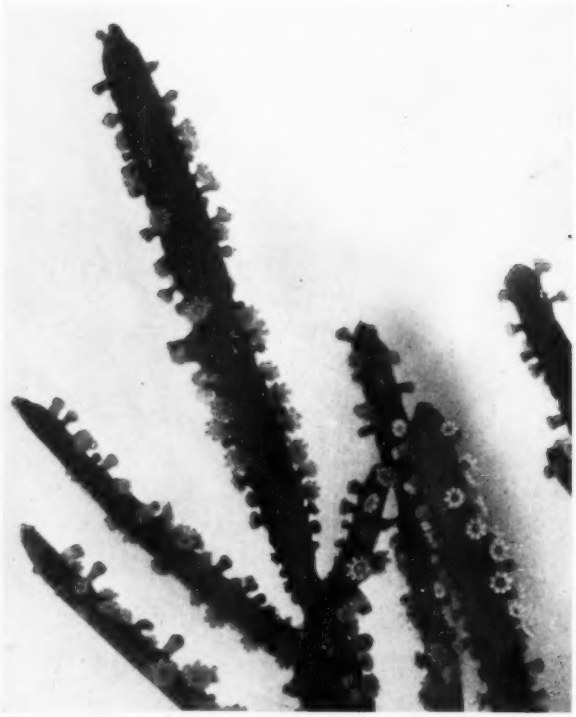
When this rock was a sandy beach ages ago, the plant roots growing in it became encrusted with lime. They are shown here, eroded from the solid limestone by the action of the waves

SOLUTION PITS ON THE SHORE OF "PIRATE'S NEST"

Rain water, which is slightly acid, dissolves the limestone rock, forming thousands of cavities. As the water evaporates, the lime is redeposited on the bottoms and sides of the pits

On account of the fragility of the cortex when dried, it was necessary for us to take special precautions in sending the specimens to the Museum. To prevent them from drying, we packed them in large boxes between layers of wet sponge-clippings and shipped them to New York by each steamer. There they were received by the departmental modeling staff, submerged at once in weak alcohol, and then passed through various solutions to be finally impregnated with wax or liquid celluloid, so that they could be hardened in natural positions and colored for exhibition in the group.

Through the courteous coöperation of Mr. Bacon, we received every facility for this work and succeeded in shipping an abundant collection to the Museum. With his speedy and efficient motor



LIVING GORGONIAN POLYPS

These are the flower-like animals which build the sea-plumes and sea-bushes. Each is a tiny cylinder surmounted by a disc of tentacles around a central mouth. They extend through minute openings on the surface of the sea-bush

cruiser, the "Escape," we visited a wonderful submerged coral reef at Rose Island, where the gorgonians were particularly abundant and of large size. There, with the aid of a native diver, we added many of the larger growths to our collection. A diving helmet was among the facilities at our disposal, but we were greatly hindered by an unprecedented series of northwest storms, which made helmet-diving impossible until I had returned from Andros in April, when we had excellent opportunities which I shall shortly describe.

One fine morning, Mr. and Mrs. Bacon took the "Escape," with Johnson as crew, and went fishing on the north side of the island. Mrs. Miner and I were out at the western end, wading in the shallows and collecting gorgonians and other specimens. We had the cameras cached on a near-by rock and after a while we went ashore and started to take photographs and motion pictures of the surf and the rock formations on that part of the island. Soon we saw the "Escape" making her way into the harbor between the western end of Pirate's Nest and North Cay, finally anchoring on the south side of the latter. We returned to the bungalow for luncheon and afterward resumed our photographing. We saw that the "Escape's" dinghy was drawn up on the beach at North Cay and thought that the Bacons had decided to picnic on the beach. Suddenly we noticed that it was getting very dark on the western horizon and that heavy showers were passing over the sea to the northwest. Hurriedly packing up our cameras and plates, we made our way laboriously over the rough rocks to the bungalow. By the time we had reached it, the sky was very dark and the wind had increased, so, with the help of Fred, we closed all the windows and shutters and then anxiously turned a pair of field-glasses toward North Cay. Apparently the Bacons had just realized the approach of the storm. Afterward, we learned that they had been sitting under the lee of some rocks and low trees and had not noticed it at first. Now they were hastily rowing out to the "Escape," the dinghy tossing like a cockle shell on the sea, which was quite rough.

We were standing on the south porch with our mackintoshes wrapped around us, partly protected from the rain which was coming from the northwest, and had a good view of the harbor. The "Escape" was just getting under way when the storm broke. The waves, crested with white

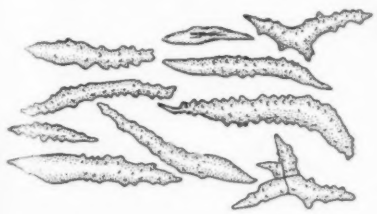
rushed past the wharf, which had been rebuilt since we arrived, and were almost over its top. They were going like wild horses. We could see the "Escape" coming full speed and wondered how our friends were going to pick up the mooring buoy. Soon we saw they did not intend to try, as the boat raced past the end of the pier and headed toward Nassau, the distant buildings of which had become invisible.

Almost immediately, the long shore-line and hills of New Providence completely disappeared from view and at once the "Escape" was swallowed up in the mist. The rain was driving past us in a horizontal flood, while the poor hurricane-whipped coconuts were bending low before the onslaughts of a terrific northwester. While we were much worried about the Bacons, we had the feeling that they could make Nassau.

After a while the storm began to abate visibly, though the wind was still blowing with gale force. The mist lightened somewhat and to our dismay we saw that the two dories which, fitted with masts and with sails furled, had been placidly lying at anchor off the wharf, had dragged their moorings. One of them, Tony Work's boat, was just disappearing in the mist in the direction of New Providence, and the other was several hundred yards away from its anchorage and still going. This gave us a queer feeling of being marooned, as we were now without any boats whatsoever, but we felt that the Bacons were in Nassau by this time and would come out to us when the storm passed by.

And just then we saw them coming! Fighting her way out of the mist against the wind, the "Escape" proudly breasted the waves as the white foam fell gracefully and symmetrically on either side of her bow without wetting her deck. She was close inshore and it was evident that she would try to pick up her mooring. Johnson was standing in the bow like a statue, slightly bent forward with boat-hook poised in his hands, rising and falling with the vessel as it rode the waves, but maintaining his balance apparently without effort.

We rushed out of the house through



(*Above*) A sea plume (*Gorgonia acerosa*). If examined through a hand lens, its outer surface is seen to be perforated with multitudes of pin-holes.
(*Left*) Carbonate of lime spicules, highly magnified

DOCTOR MINER PREPARING TO DIVE
The diving helmet is about to be placed over his shoulders as he prepares to descend to the sea bottom at the Rose Island reef

the driving rain which stung our faces like needles. The wind beat us sidewise as we ran down toward the pier. Just then Johnson plunged his boat-hook into the water and caught the mooring rope. In an instant, the hook was jerked out of his hands and was lost in the tossing waves. We stopped, startled, as we realized what had happened. The "Escape" was now without a mooring, and later we learned what then we did not know. When she had disappeared in the mist during the height of the storm, the floods of rain were so intense that the Commodore, Mr. Bacon, could not see the bow of his boat, and, fearful of running on the dangerous Tony's Reef and the wreck of the "Princess Montague," he steered too far to the left, grounding the "Escape" on Silver Cay. He backed off immediately, but found that his starboard propeller was jammed and out of business. As an aid against possible consequences, all three donned life preservers, for they did not know where they might strike next. Luckily, they were able to fight their way to comparative shelter under the eastern end of "Pirate's Nest," and, when the storm let up a little they made the run for home.

Now, here they were, without a mooring, and with but one effective propeller, on a rock-bound lee shore relieved only by the tiny sand-spit where we had first landed. They chose the spit, and when we saw them heading for it we hastened to be of assistance if possible. Johnson again stood in the bow, this time with anchor ready, apparently with the intention of casting it into the sand as a mooring while the Commodore drove directly at the spit to beach the boat. Just then, as they reached shallow water, the "Escape" lurched, Johnson lost his balance, and in recovering himself, dropped the anchor overboard. Like a flash the anchor rope was carried under the boat, and was cut by the port propeller becoming fouled with it.

MRS. MINER TAKES HER TURN
She has descended a ladder lashed to the side of the "Marmion" and is now sliding down a rope from its bottom rung to the sea floor

The poor "Escape" was now helpless indeed. Mr. Bacon headed her away from the beach, but she immediately began to drift toward the jagged, eroded cliff which bounded the entire shore.

Hurriedly sending Fred back to the boathouse for a rope, Mrs. Miner and I ran along the steeply sloping rocks to keep pace with the boat as she drove inshore. We stumbled and caught our feet on the projecting pinnacles, and on the limestone-encrusted roots of former bushes which projected like snares from the face of the cliff. Heedless of these, we managed to keep opposite the boat while Johnson stood ready to throw us a rope. Soon it came hurtling through the air. Luckily, I caught it and quickly bent it around a rock pinnacle before it snapped taut, and then around the trunk of a low tree near the top of the cliff. The "Escape" stranded and tugged at the rope like a frightened horse, but fortunately it held.

THE DIVING HELMET IN POSITION
Air is now being pumped into the helmet as Doctor Miner disappears beneath the Bahaman waters

GATHERING SEA-PLUMES ON OCEAN BOTTOM
Standing before the coral reef with its wonderful sea gardens, Mrs. Miner assists in collecting museum specimens at a depth of twenty-five feet

By this time Fred had arrived with the other rope and threw it aboard to Mr. Bacon, and Mrs. Miner quickly fastened the other end around a bush, as we helped her hold it. Soon we had the "Escape" moored to the cliff a little distance out. We tried our best to fend her from it as we drew her in closer to enable her passengers to get ashore, but the force of the wind kept driving her against the rock shallows below the water line.

Acting under Mr. Bacon's direction, Johnson now brought the blue dinghy around from the stern between the "Escape" and the shore, while we held her off as best we could. Mrs. Bacon scrambled down into the dinghy and we pulled her up the cliff as she balanced on a thwart and reached toward us. Mr. Bacon followed suit and finally Johnson jumped across. At last, all were ashore, and we made haste to pull the dinghy up the rocks and secure her, for she was now our only boat.

THE GORGONIANS GROW TO UNBELIEVABLE HEIGHTS
Their slender branches wave back and forth in the ocean currents. Each branchlet is outlined by rows of translucent, flower-like polyps

For the first time the tenseness left us and we shook hands all around and expressed thankfulness that everybody was safe. The poor "Escape," however, was banging against the rocks. We tried our best to ease her, but soon saw there was nothing more that we could do. So, there we left her to batter her life out during the night, while we struggled back to the bungalow. Fred ran ahead to get some shoes for Mr. Bacon for his were left on the boat, and walking over the rocks with bare feet was practically impossible. Soon, however, everybody was dry and warm, and after a good supper the returned sailors were none the worse for their thrilling experience.

The next morning, we were just wondering how we would get ashore when we heard the puffing of a motor and saw a Munson launch coming up to the dock. We ran down and our good friend Jimmy Sands stepped off. He had worried about us during the storm, and at daybreak ran his car along the New Providence shore until he was opposite our island. Looking through his glass, he saw the "Escape" on the rocks in distress, and, still more alarmed, hastened back for a launch to come to the rescue. We all went in to Nassau, glad of the chance, and a little later the "Escape" was towed to the shipyard. She had received considerable damage, but afterward was put into shape and now is as good as ever.

About April first it was time to leave the island, so we all packed up and departed with much regret, the Bacons to sail to New York, Johnson to help them aboard, and, after saying "good-bye," to hasten around the corner of the dock buildings so as not to see them sail. Mrs. Miner and I remained in Nassau to await the coming of Mrs. Fish, who was to stay there with her during my trip to Andros with Doctor Fish. A few evenings after

she arrived, the good ketch "Marmion" dropped anchor in the harbor and I made the acquaintance of her owner, Hugh Matheson, the beginning of a friendship which I hope will long continue. The events of the voyage to Andros on the "Marmion," the meeting with the launch "Soforth," and the adventures on the sponge-banks and in the interior of Andros with Charley Fish and Maurice Black, to say nothing of the way in which we "scuttled the ship" in the lagoon at Mangrove Cay, form a story which I hope to tell at another time.

Let us jump forward to the day after we had returned to Nassau on the "Marmion." The weather was clear and beautiful and the water was as smooth and calm as one could wish. Hugh Matheson, Charley Fish, and Maurice Black were aboard. Mrs. Miner and Mrs. Fish were with us once more. We were just dropping anchor before a magnificent coral reef off the shore of Rose Island, planning for a day of under-sea work. We warped the boat in close to the reef and moored it fore and aft. We could look down and see clumps of coral, overgrown most luxuriantly with groves of sea-plumes and sea-fans. So we put a ten-foot ladder over the side, lashing it firmly in place.

We had our two helmets in readiness and the air-pumps in working order. The under-sea movie camera was loaded and screwed into its brass box. The front glass was carefully polished and a light rope was secured to the handle on the box-top. It was my turn to go first, so I climbed over the side, the helmet with its weights was adjusted to my shoulders, and the pump started. The clanking noise of the air entering the helmet began with satisfying regularity and I climbed down the ladder until the water-surface was over my head. The helmet, which had weighed heavily on my should-

A PICTURESQUE VISTA ON THE SEA BOTTOM
The reef is entirely composed of these graceful growths, their soft colors illuminated by the sunlight filtering down through the blue waters

SPECIMENS OF SEA-BUSHES

These plantlike animals, collectively known as gorgonians, grow from the crevices between the coral masses, covering them with their waving fronds of purple, magenta, brown, and yellow, giving weird beauty to the coral vista

ers, lost all feeling of gravity. I deseended, watching the keel of the "Marmion" come into view, with its rudder and propeller looking very odd as they floated above me.

Now I reached the end of the ladder and, as the sea bottom was still a dozen feet below, I tied a rope, which I had brought with me, to the bottom rung. It insisted on floating up to the water-surface, but as I swung on it, the loop ran through my hand and, almost at once, I stood on the sea floor, feeling as though I had no weight. Twenty feet above me, the bottom of the ketch floated in the midst of a mirror of liquid silver. Clouds of silvery bubbles rose from beneath my helmet and streamed upward to the surface. As I looked, I saw my camera box descending through the water on the end of a cord. It thumped softly in the sand at my feet, sending up little clouds of ooze. I picked it up and waited.

Almost immediately, the legs of Charley Fish showed, as he stood on the ladder half-submerged. Soon he began to descend, his blue bathing suit coming into view. Then his helmet appeared, giving him the aspect of a marine hobgoblin. He slid down the rope and stood before me. I pointed the camera at him and pushed down the lever. He half-walked, half-swam toward the reef and began to examine the corals. After the fifty feet of film ran out, I jerked the cord and the camera rose out of my hands and disappeared above me.

Now I had leisure to look about me. Keeping my feet on the bottom with some effort, I leaned against the current and, moving my hands to aid me, went closer to the reef. It mounted toward the surface in terraces, tier on tier. Forests of waving sea-bushes grew among the heads of coral, yellow, purple, and brown in color. Their

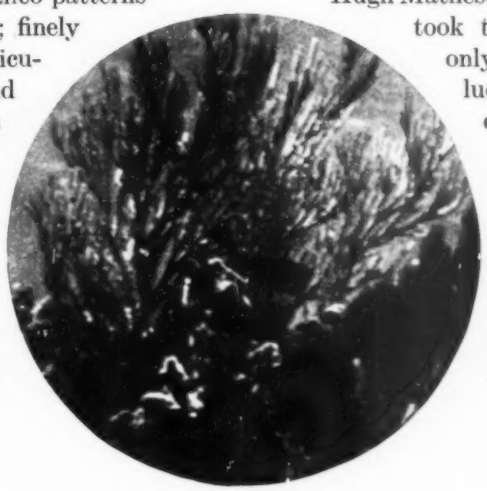
thickly-set branches rose vertically, parallel to each other, and swayed back and forth with the current in slow, dignified fashion. Their cylindrical stems—tan, lavender, purple, and brown—blossomed with close-set, flower-like polyps, varying in tint in different species. I touched a branch and immediately the polyps disappeared into their pin-hole dens.

The silver-blue light of the watery atmosphere filtered through the vistas of waving branches, lighting up the purple plumes of sea-feathers and the flat fronds of yellow or magenta sea-fans fretted with lacy perforations.

Athwart my vision darted a gleam of jewelled splendor. It was followed by another and another. Hosts of sapphire-blue *Chromis* fishes were flashing everywhere. I quickly extended my hand toward a particularly handsome individual that swam within my grasp, but found it impossible to touch him. He darted and turned just outside my reach. Blue-heads swam past, adorned with green, white, black, and blue; slippery dicks showed off in calico patterns of light blue and pink; finely striped grunts, conspicuously barred jacks, and gorgeous angel fishes played about or swam in stately processions across my field of view. Reluctantly, I moved over to the rope which had been tied to a marlin spike to keep it down. I pulled at it and rose through the water without effort. When I came to the ladder, I did not need to touch it with my feet. The pressure of my hands on the rungs sent me gently upward. Upon reaching the surface, however, I had to seek support on the ladder, for my helmet suddenly became heavy and was lifted from my shoulders by my companions as I climbed on deck.

While I changed the camera film, Mrs. Fish donned the helmet and disappeared below the surface of the water. I lowered the camera down to Charley and he photographed her as she gathered sea-plumes. Next, Mrs. Miner and I descended and she helped me memorize the positions, colors, attitudes, and groupings of the various sea growths, for use in the coral reef group, as I silently pointed them out. It was possible to stay on the bottom for an indefinite time without inconvenience. In fact, one was conscious of a pronounced feeling of exhilaration during the entire period.

Hugh Matheson and Maurice Black took their turns next and only with the greatest reluctance left the bottom of the sea and its fairyland of form and color for the stern realities of life for we had to weigh anchor and sail away to Nassau to organize our affairs for the voyage home.



GORGONIANS AMONG THE CORALS

THE CORAL POLYPS DEPOSIT CARBONATE OF LIME BENEATH THEIR LIVING TISSUES, THUS BUILDING UP THE RIGID CORAL REEFS OF LIMESTONE. ON THE OTHER HAND, THE GORGONIAN POLYPS, THOUGH SIMILAR TO THE CORAL ANIMALS, BUILD BUSH-LIKE STRUCTURES OF FLEXIBLE HORNY MATERIAL WHICH WAVE, PLANTLIKE, IN THE CURRENTS OF THE SEA

THE SITE OF TICOMAN AS IT APPEARED DURING ITS OCCUPATION

RECONSTRUCTING THE BEGINNING OF A HISTORY

Bringing Back to Life the Material Culture of the Valley of Mexico through Its Archæological Remains—The Inhabitants of Ticoman

BY GEORGE C. VAILLANT
Associate Curator of Mexican Archæology, American Museum

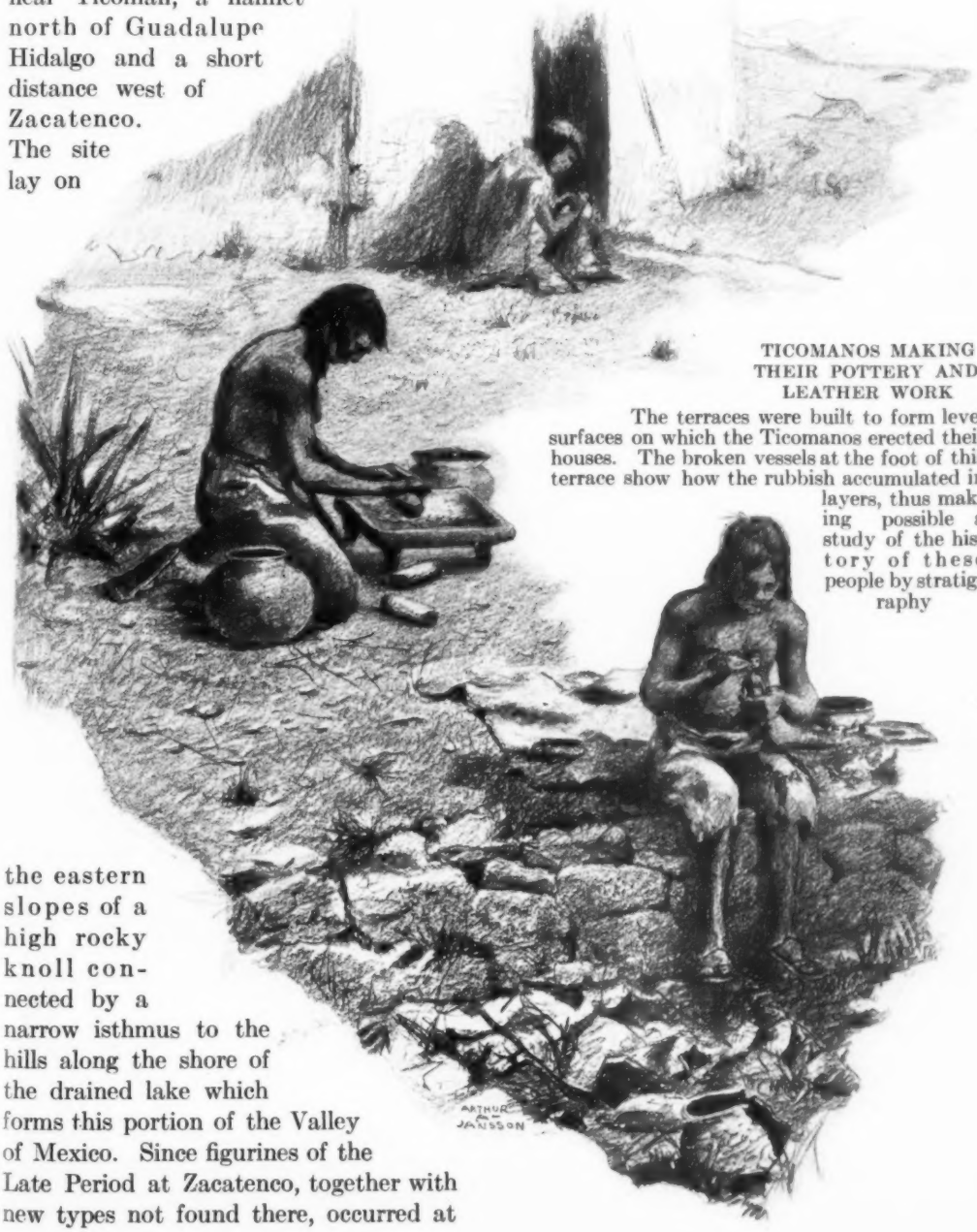
THE reconstruction of man's past presents two roads for the student to follow. One extends toward chronology and the rigorously scientific treatment of the remains by classification and by their position in the ground. The other route is more interpretative and strives literally to clothe with living flesh the dry bones of the past. Yet each study supplements the other, for the dry classificatory research tries to answer the questions of *when* a given people lived and *who* they were, while the more imaginative study strives to explain *what* they did and *how* they did it. If one remembers these points, the labors of the archæologist appear less devious and bear more directly upon the activities of an institution like the American Museum of Natural History in its presentation of the mysteries of Nature.

For the last three winters the division of anthropology included in its program an effort to reduce the sculptures and pottery of clay found in the Valley of Mexico to an orderly sequence in time and culture as a supplement to the old Spanish and Indian chronicles of Mexican history. By a knowledge of these pottery types it would be possible not only to identify and date sites mentioned in the migration myths, but also to project the history of the Valley further into the past by the recognition of influences and peoples which, having passed from human memory, were unknown to the chroniclers. After a preliminary survey, the officials of the division of anthropology decided to begin with the earliest discovered remains and then work upward in time toward the Toltecs and Aztecs whose histories comprise much of the ancient

literature. During the winter of 1928–1929 excavations were made by the writer at Zacatenco just north of Mexico City, and an account of the work is to be found in NATURAL HISTORY for September–October, 1929.

The point selected for excavation in the winter of 1929–1930 was near Ticoman, a hamlet north of Guadalupe Hidalgo and a short distance west of Zacatenco. The site lay on the eastern slopes of a high rocky knoll connected by a narrow isthmus to the hills along the shore of the drained lake which forms this portion of the Valley of Mexico. Since figurines of the Late Period at Zacatenco, together with new types not found there, occurred at Ticoman, and since the two sites were less than an hour apart, the place seemed most suitable for the continuance of our studies. The subsequent operations justified the choice of Ticoman for work.

The inhabitants of Ticoman chose the site for the security of its position and the



TICOMANOS MAKING THEIR POTTERY AND LEATHER WORK

The terraces were built to form level surfaces on which the Ticomanos erected their houses. The broken vessels at the foot of this terrace show how the rubbish accumulated in layers, thus making possible a study of the history of these people by stratigraphy

arable ground near it. Since the hill was almost completely surrounded by water, no enemy could approach save by boat or along the narrow, rocky isthmus which could be held by a handful of men. This neck of land was long enough to keep the settlement out of range of missiles discharged by foes on the mainland. The prevalence of low walls of stone showed that the people may have had back-yard gardens near their houses, and the rich soil of the mainland offered excellent fields for the cultivation of corn, the main food staple. The Ticomanos lived first near the top of their knoll, but as time went on, their heaps of débris, strengthened by low walls to make gardens and house foundations, extended to the edge of the lake.

Data on the physical type of the Ticomanos are not now available, for the study of skeletal material has not been completed. But from the evidence at hand they were of moderate stature and had skulls somewhat flattened at the back, more probably from use of the cradle board than from deformation to fulfill an æsthetic ideal. The rigors of a hard life in the field and on the hunt prevented most of them from reaching any great old age, while the lack of sanitation in a primitive community exacted its toll in the premature death of infants and children. Furthermore, like most people of the past and present whose diet is mainly vegetable, they suffered from decayed teeth.

The ordinary activities of the people were pacific. Arable land lay near to the site, and such finds as lava corn grinders set on three oblong legs and vast numbers

A STORAGE OLLA AND FIGURINES, TYPE E

From the early occupation of Ticoman. At this time sculpture in imperishable materials was confined to relatively simple styles, and the pottery was more utilitarian than æsthetic. The vessel shown above is painted red on white and is much restored

BOWL AND FIGURINES, TYPE H

From the late occupation of Ticoman. Note the development of the sculptor's art as shown in the vitality of the expressions and poses of the figures. The small bowl is made of quartzite

of heavy storage vessels attest to their agricultural pursuits, but bird and deer bones show that game supplemented their larder. Their position on the edge of the lake makes it probable that they also ate fish, although owing to the perishable nature of the bones, we found no certain proof of this.

There is little evidence of cultural accretion at Ticoman other than through autochthonous evolution. Pottery, both decorative and for storage, followed utilitarian needs more than it expressed æsthetic ideas. The great storage ollas went through a gradual change in rim form. Decoration of smaller vessels, presumably for the service of food, passed from polished surfaces and relatively simple designs, incised or roughly painted, into more sophisticated experiments, like painting in two colors on the base clay and achieving thereby polychrome decoration. But this style was later abandoned in favor of vessels with polished surfaces, red for the most part. Only a few sporadic examples occurred of painting in lost color, a process in pottery painting resembling batik in textiles.

Baked clay, however, was further utilized for such varied purposes as figurines, probably for ceremonial use, ladles for food, whistles, flutes, balls for games, and even ornaments like beads, and lip and ear plugs, some of which are highly ornate. The ear plugs began as simple solid cylinders and became gradually elaborated as the makers' technique progressed, and they learned to make rings, or having hollowed the interior of the cylinder, to carve the closed end. Pottery balls diminished in quantity as time went on, while stonework showed a slow growth toward perfection and elaboration in manufacture.

Sculpture in imperishable materials was mainly confined to the figurines which

BOWLS FOUND IN BURIALS AT TICOMAN
The upper bowl at the left is early, but the others are mainly from the latter phase of the occupation. In this picture the bowls are shown much restored

began in a relatively simple style (Type E). Almost coincidentally with the practice of painting polychrome pottery the figures became more varied in position and sometimes represented grotesque subjects (Type G), which seem to have arisen from the intention and not from the ineptness of the artist, as we shall see when we come to take up the ceremonial life of the Ticomanos. Other new styles (Types L and I) were taken up, and the surfaces of the figurines came to be polished. Toward the end of the period this variety tended to crystallize into naturalism (Type H). Not only were lifelike postures adopted, but humor, which as a consciously executed trait is almost unknown to primitive art, may be seen in such figures as the little lady hiding her eyes in shame, or the vain little creature roguishly prinking.

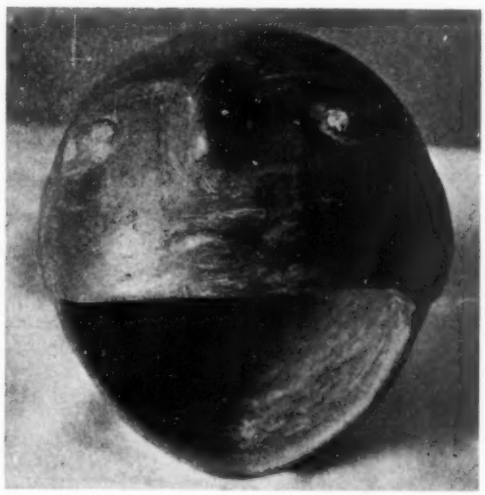
Two specimens exist of sculpture in stone, one small very crude kneeling figure and part of an incense vessel, with its bowl supported by a seated figure, a conception known in Aztec times as the Fire God. These two pieces may have been received by barter, but they may, on the other hand, show that the Ticomanos were already on the verge of stone sculpture. Two pebbles were also found that may have been kept because of their resemblance to natural forms.

Stone was in any case used commonly by these people in the making of tools. Long blades for knives were struck off from conical fragments of volcanic glass, and the residue chipped into projectile points. Implements presumably for graining hides were made also from obsidian, and quartz was much used for the same purpose. For heavier work like grinding corn, the Ticomanos made manos and metates from lava. Balls like those of pottery mentioned above were also made from quartz or from lava. In an angle between two walls thirteen of these spheres were found, nine of pottery and

four of stone. It is problematical whether they served as missiles or as elements in a game. Axes made from porphyry and jade do not seem indigenous and may have been traded from the State of Guerrero.

Bone and horn were useful for a wide range of utensils, extending from fine needles made of bone to heavy scrapers made from the shank of the horn. A thin bone sliver was even polished and shaped as a pendant. The Ticomanos must have been utilitarian to the point of cold-bloodness or else most naïve about comparative anatomy, for we find a scraper made from a human fibula.

Shells from both coasts of Mexico were much used as ornaments. Sometimes they were merely perforated for suspension, at other times they were cut into disc or tubular form for beads. A pair of shell tinklers were identical with ornaments found at the great city of Chichen Itza in Yucatan, an evidence of the long existence of a satisfactory technique of manufacture.

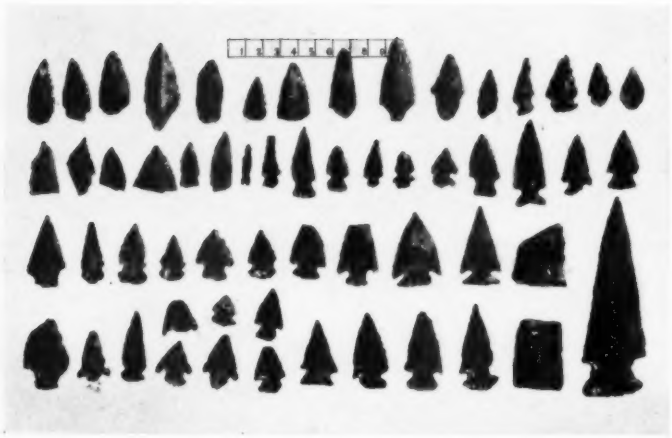


A MORTUARY OFFERING
This bowl in the form of a human head was found in a grave of the Middle Period. It is now in the Museo Nacional, Mexico

Beads of jade and chalcedony and a pendant of chert showed by their rarity how much they were prized, and we see even in those distant times how value depends on scarcity and desirability. One man actually wore a necklace of coyote teeth. Several pebbles of moonstone, opal, and chalcedony occurred in the digging, doubtless preserved as medicine stones because of their odd appearance. Ornament seems to increase in variety and in decorative value, for there are many more kinds of objects of every type at the close of the occupation than at the beginning.

Such were the tools and ornaments of the Ticomanos, which have survived the destruction of time. Many implements of perishable material like wooden spindle whorls and digging sticks have disappeared. The weaving industry may be inferred through the presence of mats lining the graves and by a tiny fragment of a feather robe in another sepulture. It is not then stretching our imaginations or our data so far when we suggest that these people wore woven clothing. Hides they must have used a great deal, for the burials kept yielding evidence of considerable work in leather. One old man was interred with a hammer stone, two horn grainers, and three obsidian scrapers, all useful for the preparation of the skin, three heavy awls for the boring of holes in preparing moccasins, for example, and two bodkins for the finer sewing. Another had a number of beautifully shaped obsidian knives with a full equipment of awls and needles.

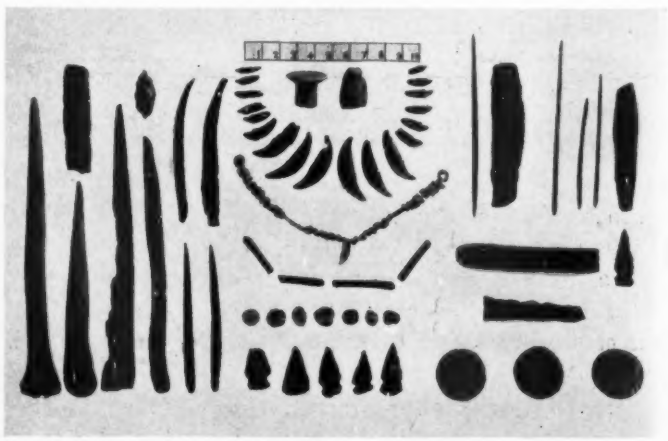
Hunting is shown by the presence of bird and animal bones in the dumps, by numerous arrow and dart points, and by an occasional lance head. It looks as though both the bow and the atl-atl or dart-thrower might have been used. Little evidence, however, exists of a warlike spirit, because no stone club heads were found in the débris nor were weapons buried with the dead.



PROJECTILE POINTS OF OBSIDIAN

The crude specimens of the top row are mainly early; of the second row, early and middle with a utilization of flakes of obsidian in contrast to the fragments of the top row. The more perfect specimens of the bottom two rows are late and middle, and the remainder are early occupation examples

The social customs of the Ticomanos are difficult to infer. The population lived together on their knoll, probably communally as do most undeveloped people. If there was a complicated religion with priests, there is no reflection of it architecturally. The architecture of the Ticomanos in fact is conjectural. Long revetment walls terraced the hillside and only at one point did we find a suggestion of house foundations. Doubtless the Ticomanos lived in wattle and daub jacales, but we were unable to ferret out evidence of temples, defense walls, or formal house foundations. The figurine cult flourished, as we have said, and at the middle of the occupation we find figurines with grotesque heads like a gopher. Gopher teeth, moreover, were occasionally buried with the dead. Perhaps some connection might have existed in the minds of the Ticomanos between the dead in the underworld and these little burrowing animals, for the soft ground of an interment would offer a splendid place for a gopher to hollow his lair and the fragments of bone at the mouth of the burrow might have suggested to the Ticomanos an affinity between the gophers and the dead. One figurine showed an animal-headed figure holding in its arms a human being, so that a distinction must have existed in sculptors' minds between human and grotesque forms. Yet at the close of the Middle Period this practice faded. The stone sculpture representing the Fire God, a divinity commonly portrayed in Aztec times, indicates another divinity in the Ticomano pantheon. Moreover, a similar figure having been found at Cuicuilco, the pyramid under the lava, and others at Teotihuacan, this is probably the oldest known characterized presentation of a divinity in Mexico.



GRAVE FURNITURE

With the dead at Ticoman were placed ornaments of bone or shell or tools of bone and obsidian. In the lower right of the picture are three lip or ear plugs. Note the needles in the upper right-hand corner

A conception of the after-world existed among the Ticomanos, for they took some pains in the disposal of the dead. Ordinarily a small shallow hole was dug and lined with matting, probably the petate or sleeping mat which is used even now on the Highlands of Mexico. The friends and family of the dead man then squeezed his body into the grave and inserted their mortuary offerings. Children were less likely to receive funeral furniture than grown-ups, but about two-thirds of the burials contained pots, or bone and stone tools. Some had beads or ear plugs and one woman carried to the next world, besides her pot and a shell bead, a figurine of a very early type that must have been an amulet. Another burial very much disturbed, probably by gophers, contained a bag enclosing cinnabar and a shell necklace as well as a tiny pot of quartzite that also contained cinnabar. After the burial ceremony was over, rocks were usually piled over the grave to keep it from washing out during the time of torrential rains and from being dug out by coyotes or dogs. One grave, with the richest content of pots and tools that we found, was covered over with slabs.

After this description of the customs and habits of the Ticomanos, let us consider their origins and their position in Mexican pre-history.

In March, 1929, when we closed our work at Zacatenco, we had discovered three phases of culture. The Early Period was closely connected through its pottery with the Middle, but the figurines of the latter showed the effects of a foreign influence. Figurines similar to these Middle Period examples occurred at Copilco, a site on the other side of the old lake of Mexico, covered by a layer of lava fifteen to thirty feet thick. The late period at Zacatenco saw the intrusion of completely new figurine and pottery types, that through stylistic considerations suggested a reoccupation of the site by a new people. This late Zacatenco complex through its pottery, especially in the use of the tripod support, its figurines foreign to the Early-Middle Period traditions, and its ear plugs, tied in roughly with Cuicuilco, a pyramid surrounded by the same lava flow as Copilco but probably abandoned before that catastrophe. Therefore, if Copilco and Middle Zacatenco are contemporaneous, and if Late Zacatenco and Cuicuilco are roughly of the same period, then Copilco must be earlier than Cuicuilco, and must have been abandoned long before the lava flow. What then brought about the abandonment of Copilco?

GRAVE FURNITURE OF AN OLD MAN
Showing a leather worker's tools of bone and obsidian. The gopher teeth were found in his lap, and perhaps were ceremonial

According to Professor Kroeber, the settlement of Copilco was on marshy ground. At Zacatenco the strata intermediate between the Early and Middle Periods yield sherds of a curious rusted appearance, as if alternately drenched

FIGURINE, TYPE G
From the Middle Period of occupation. Note the polished surface, but crude features

and dried by water at the shores of a lake. Moreover, while the Early Settlement at Zacatenco is low down on the flanks of the hill, the main Middle Period settlement is on the upper slopes. It would seem that some blocking of the outlet to the streams of the Valley caused the waters to rise, driving the people up the slopes of the hills around the Valley. This conclusion tends to be substantiated when we find that the lowest deposits at Ticoman are on the same level as the "beach" at Zacatenco, and below this level at Ticoman there is no trace of human remains, indicating that the presence of water prevented occupancy. Although we have not compared the levels of Zacatenco with those of Copilco, it would be probable that the rise of the lake waters affected the people there, driving them and other Valley dwellers out of their homes to fresh sites on higher ground. Thus the change in figurine and pottery type between Middle and Early Zacatenco might have been brought about through an amalgamation of the original occupants with some of these exiles.

The change between the Middle and the Late Periods at Zacatenco is not possible to explain through natural causes. There is no doubt, judging from their material culture, that the populations of late Zacatenco and Ticoman are the same.

Moreover, the difference in material culture between these people and the Middle and Early Zacatencanos is intensified by what Dr. H. L. Shapiro

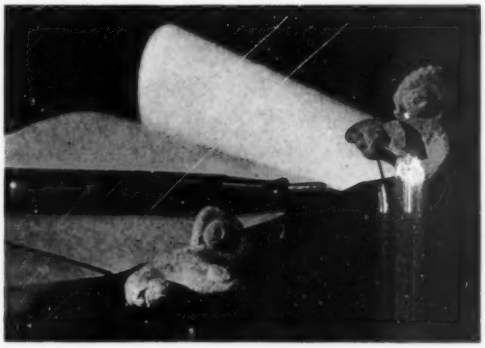
FIGURINE, TYPE I
(*Below*)
From the Middle Period. Showing, with the Type G specimen above, plastic experimentation

FIGURINE, TYPE Hiii
(*Above*)
From the Late Period. Note the reasoned attempt to achieve vitality

FIGURINE HEADS, TYPE Hi, v, and ii

From the Late Period. The consummation of the artistic experiments of the Middle Period shown on page 614. Note the expression of shame on the little figure at the left

of the American Museum, after a hasty examination of the skeletal material from the two sites, believes to be a slight but sure change in physical type. Zacatenco was probably the immediate base of the invaders but soon they must have shifted to Ticoman, which shows a longer, heavier, and richer occupation.



FIGURINES Gii

From the Middle Period. Note animal, perhaps gopher, heads, and how figure at right holds a human in his arms

On the whole we are left with the impression of a group of people relatively well advanced as primitive people go, and capable of great development, given the right religious or social impetus. But this culture, high as it is, does not seem to be the base for the high civilization found at the religious center of Teotihuacan. Perhaps another intrusion brought the elements that crystallized into the mighty Toltec culture. It is certain that here lies a great gap in our knowledge. The chronicles tell us of the collapse of the Toltecs and the infiltration of those wandering tribes of Nahuas who, after learning culture from the survivors of the Toltec era, proceeded in their growing strength, by the destruction and by the amalgamation of their tribal entities, to build up the Aztec Empire, only to be overthrown in their turn by the Spaniards. Beginning with the early inhabitants of the Valley of Mexico, we have been able to give some idea of the many disturbing forces that worked on them. We have seen how they were affected by floods, by volcanic eruptions, and by invasions. More particularly, we have traced the development

of the people of Zacatenco, their probable amalgamation with invaders in the Middle Period and their expulsion by a new group who formed the Late Period there. We have seen that these people in their turn moved to Ticoman, where the subsequent growth of their culture took place. But the occupation of Ticoman ceases for no apparent reason, relatively about the same time as the abandonment of Cuicuilco, for similar figurines are found in the latest strata of the two sites. There is evidence to show that Cuicuilco was abandoned before the lava ever came, and its people might have been warned away by volcanic activity previous to the great eruption. But certainly no such catastrophe occurred near Ticoman, nor is there any evidence of what did cause its abandonment.

FIRE GOD, CARVED FROM LAVA
The top is hollow and is much burned. It rests on the bent back of the god

Madame Nuttall pointed out a curious reflection of this ancient history in the Aztecan myth which relates the history of the world. Four periods or suns have existed and we are now living in the fifth. The first four terminated respectively in destruction of the world by jaguars, by a hurricane, by a volcanic rain of fire, and by a flood, and this era is to be terminated by an earthquake. Although the order is transposed according to our data, there is no doubt that, except for jaguars, the Aztecs quite faithfully listed the natural causes militating against the former inhabitants of the Valley.

We have extended our history into the past but it is not continuous. We lack the knowledge of the origins of Toltec Culture, and we are ignorant of the fate, not only of the people who abandoned Ticoman, but also of those whom they may have expelled from Zacatenco. Each season we try to read another page in our history of the Valley of Mexico, but the pages are in disarray and the text is obscure. Slowly we hope to reach historical order as our knowledge increases.

EAR PLUG OF CARVED POTTERY (RESTORED). ONE OF A PAIR FOUND IN AN OLD WOMAN'S GRAVE

THE DUPLICATE, WHICH IS IN PERFECT CONDITION, IS IN THE MUSEO NACIONAL, MEXICO

A frieze in the Temple of the Warriors

COLLECTORS' DAYS AND NIGHTS IN YUCATAN

The Low, Dense Jungles of Yucatan Yield Many Treasures to an American Museum Expedition

By ROBERT T. HATT

Assistant Curator of Mammals, American Museum

PHOTOGRAPHS BY THE AUTHOR EXCEPT WHERE CREDITED

THE peninsula of Yucatan juts out into the warm sea that on one side is called the Gulf of Mexico and on the other the Caribbean. Unlike the parent mass of Central America to which it is attached, Yucatan is but a flat porous sheet of limestone. The Rain-God, Kukulcan, is not unkind to Yucatan; in fact, the visitor wishes that the State was not so blessed with showers. However, so rapidly does the water sink into the rock, seeking the level of the sea, that this country is often described as arid. No river graces the peninsula; the few surface pools are quite anomalous. The State's one city is a forest of American-made windmills, many families having three or four about the house. In the back country, however, the population is largely dependent upon the drip water caught in caves.

The vegetation, of course, reflects this lack of available water. Over the land spreads a vast low jungle of small trees, of cactus and of vines. In the rainy season, which extends from April until October, everything is fully leaved and looks impenetrable. In October, however, the rains diminish and in a few short weeks the country is transformed. Many trees lose their leaves, and the herbaceous vines that before hid the country wither up and die. Then it is that the country does take on an arid aspect.

Yucatan's mammal fauna has been drawn from parent stocks of both South America and North America, but nearly every animal occurring there is a little different from its nearest relative occurring in the neighboring lands of Guatemala and Tehuantepec. Several men have made collections in this land, but no one yet has done it thoroughly and systematically, so that even those who, like us, do a little casual collecting incidental to other work, have the opportunity of discovering un-

NIGHT HUNTING AT NOON

From the dark passages of the ruined Labyrinth of Oxkintok the party has just emerged. Miss Roigneau is putting the catch of vampire bats, geckos, and an opossum out of reach of the hungry yellow dog

known forms, or of adding to the list species which were not known to occur there.

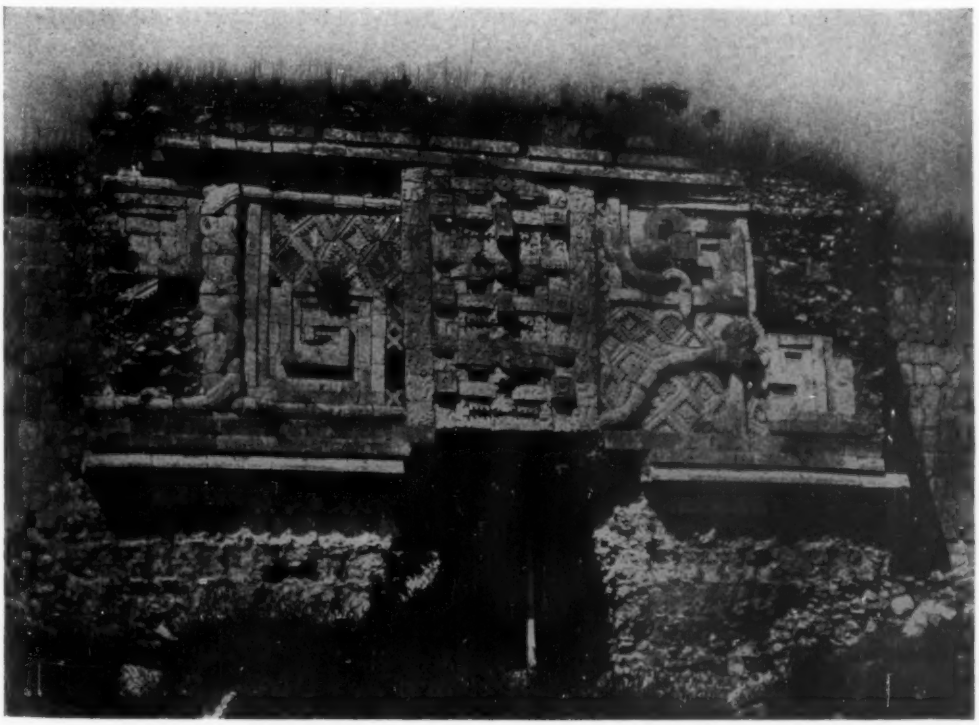
No species is entirely limited to Yucatan, for the mammals recognize it as a peninsula, even though to modern commerce it is an island served only by boat and plane.

Mérida, the capital, though fascinating to the traveler, is not a site for the vertebrate zoölogist. A cloud of buzzards, birds on which Yucatecans are so dependent for their health, and a few shy lizards are all the casual observer is apt to see by day; while by night, if one goes to a moving picture theater, a few bats fattening on mosquitoes give Draculic effect when they cross the screen. Even the State Museum, which boasts a room devoted to local natural history, is so rarely open because of the continuous procession of fiestas and the interruptions of siestas that one is indeed fortunate to gain access to its corridors, though these well repay the visitor for a dozen ineffectual trips. We tarried in Mérida no longer than was necessary to gain our permits and equipment. A trip by railroad that would be tedious to any but one making it for the first time took us through the great plantations of hennequin to the town of Dzitas. This little settlement would indeed be a jumping-off place if it were not for the miracles wrought by the electric plant and comfortable buildings put up by the Carnegie Institution of Washington at the headquarters of its Mayan researches—an hour's hazardous automobile ride into the brush from here.

Collecting at Chichen Itza was made easy by these conveniences that are available in few other places in Yucatan. Here there were comfortable quarters, trails, and guides. Best of all, the vast jungle stretching unbrokenly to Guatemala was everywhere within a stone's throw. But all these excellent features did not compensate for the distraction of the magnifi-

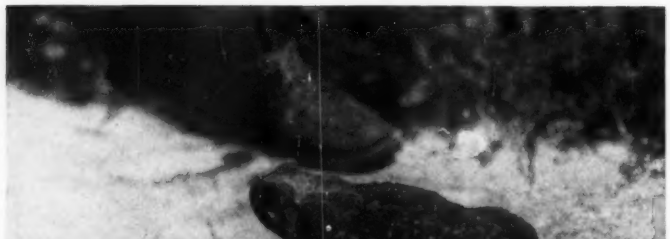
cent, enigmatic buildings of the ruined ceremonial city of the Mayas that rose majestically on every hand and the innumerable less fortunate buildings crumbling hidden away in the brush. It is not unusual, when wielding one's machete along the trails cutting down obstructing tangles, to find before one a rock bearing the image of a warrior in elaborate ceremonial dress, or perhaps the wide-open mouth of a feathered rattlesnake. It is much less usual to encounter a living scaly rattlesnake. These are there, however, along with the deadly fer-de-lance, the beautifully colored and effectively poisonous coral snake, and boa constrictors of impressive size. More frequently one encounters among the ruins a powerful six-foot mahogany snake, which the Mayas call "bohom," harmless to man but a feeder on other snakes. The most surprising of the serpents is a lithe green snake so drawn out that it can with difficulty be distinguished from the climbing vines among which it lives. The most marvelous of all snakes escaped our notice, though the Indians assured us of its existence. The serpent as described is of the same diameter throughout, very poisonous, and, unlike other snakes, progresses by bounding along as though made of rubber. It is said that this strange creature is so soft that when hit with a stick it breaks in two, each part regenerating then into a new individual in a manner previously unknown among vertebrated animals.

Conspicuous on the ruins are the snake's legged relatives, the great gray iguanas, which take refuge in the crevices while everywhere their emerald young dart out of danger. I soon found that



A HUMAN-HEADED SERPENT

In the decorations over a section of the Nunnery of Uxmal is twined this variant of the sacred plumed serpent. This elaborately decorated quadrangle is to be reproduced at the Chicago Fair in 1933



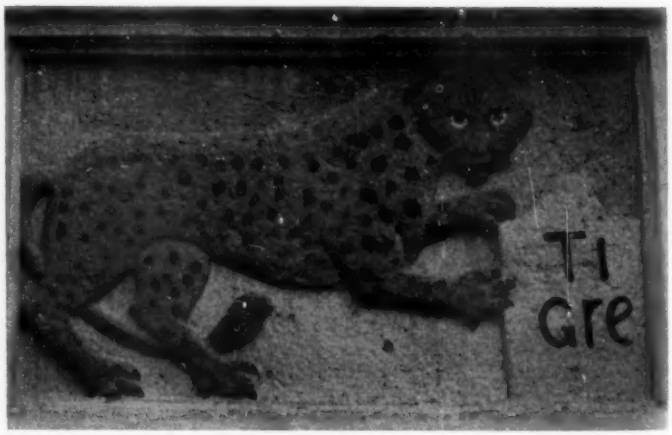
A GIANT TOAD

These mammoth amphibians eat great tarantulas and large poisonous centipedes. The swollen poison glands on the toad's neck poison in turn the dog or cat so indiscreet as to pick one up

shooting was not an easy way to get the big ones, as they did not encourage close approach and carried away tremendous loads of lead. I next resorted to trying to pull them out of their hiding places by their tails, but each time they proved the better opponent. It might be that I was lucky at that, for it is questionable whether I could have avoided their savage jaws when once I got them out. My next move was to set heavy wire nooses about holes which I knew they frequented. To these I would attach a string and to this a rock, so arranged that when the noose took hold, the rock would fall down the wall of the temple, jerking the lizard with it or pulling it out sometime after when its endurance was worn.

The great crested basilisk lizard, which the Mayas know as "tolok," was sometimes seen sunning itself in the trees. Deep in the dark inner rooms of the ruins, as well as in the caves which we later visited, were the most striking of all the lizards, the geckos. We were warned by our several guides that they were deadly poisonous, that they were *parientes de los serpentes*. One does receive a peculiar sensation when one of these distorted creatures with clammy, soft, ill-fitting skin, and bulging, golden catlike eyes, clamps its suction-cupped feet upon one's finger and does its best to bite. In the houses lives another gecko, a diminutive and comic-looking edition of the cave species. The Indians call the big one "nohcan," while the little one is dignified with the name "xpedzkim."

One little chameleon that darted about the small trees would give itself away when it was most effectively concealed. Excitement was too much for it and, if approached, a little fold of skin over the throat would be thrown out and so expose two bright blue spots surrounded by pure white scales inlaid on a yellow ochre skin.

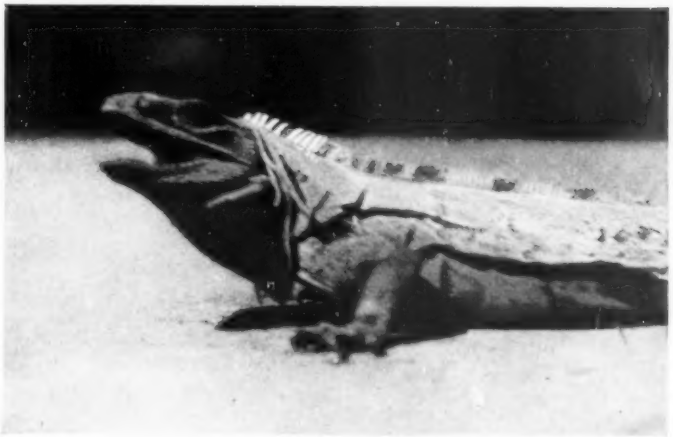


A SPANISH-COLONIAL JAGUAR

Antiquated carvings lend color to the buildings of the modern capital. This curious old slab, with an accompanying verse, is built into the wall of a recent building in Méridá

Left undisturbed, the gaudy colors disappeared and again the lizard was well concealed.

Giant toads were a constant source of wonder, but never so much so as when we eviscerated one so that it would be small enough to enter our largest tank. Then we found that its dinner had consisted of a huge tarantula, a five-inch centipede, a big grasshopper and several hard-shelled beetles.

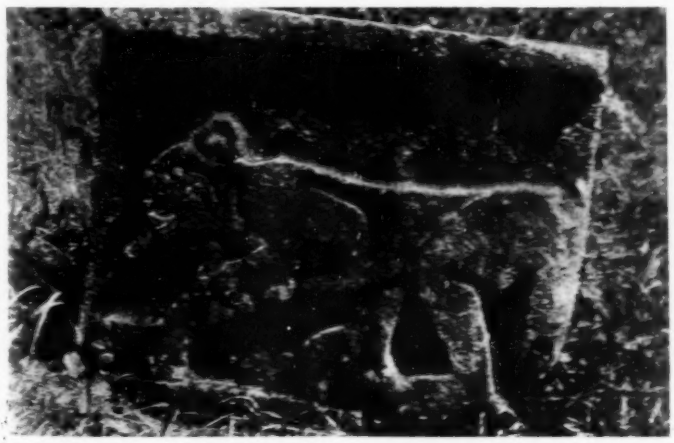


A GIANT LIZARD

Huge gray iguanas frequent the ruins where their grotesque countenances harmonize well with the gargoyle-like stone lizard heads. Their quick-snapping powerful jaws make them a dangerous reptile to handle

Under a high cone of earth in the ruined site of Oxkintok is a structure known as "El Labyrinto." It is not a true labyrinth for, provided with a light, one could not easily become lost in it. It consists of a series of fifteen long, shoulder-width, head-high tunnels of masonry, each of which typically gives off a door to another at some point before its blind end. By following out all the proper leads one emerges by crawling through a small hole not far from the one by which one enters.

We were warned of the danger from little green snakes (which proved to be our harmless friends, the geckos), but anticipating good bat collecting, we brought with us a short-handled landing net. We had not gone far before the narrow passages were filled with scores of fluttering bats which, confused by our headlights, flew into our faces and were easily knocked down and picked up—for a minute. Then one of our two men, a Maya who was unbalanced in mind, grew excited and ran ahead, followed by his mongrel dog. Between the pair, our little collecting party grew so confused that the bats had the better of us and made good their opportunity to escape. These bats, though vampires, did not bite except when they defended themselves on being more quickly than carefully picked up.



MAYAN JAGUAR

This active-looking cat fallen from the frieze of the "Temple of the Tigers" at Chichen Itza now guards the Ball Court of the famous ruined city

When the uproar had about subsided the little dog discovered an opossum hiding in a small

YUCATAN JUNGLE

The jungle is a low, thorny scrub. Rarely does one find it so open as here where it covers an extensive cave. Though bare rock was prevalent, a Maya was starting a corn field

pocket formed by the falling out of a builder's stone, and with our hands and pockets full of fighting specimens we made our way to the more than ever spacious outdoors, where the catch was more easily disposed of.

One night we were assured that "*Falta poco mas a mi milpa donde hay muchos conejos y pisotes.*" Perhaps it *was* only a little farther to the boy's jungle clearing, but we had been hearing the same thing for two hours and were a little sceptical. I felt, too, that by the way we rushed along over the tortuous dark trail, we frightened away more rabbits and coati-mundis than visited his garden in a month. It was at times a temptation to leave this Maya boy to his own hunt, but we had gone too far already and could never have found our own way back to Chichen over these branching trails.

After a long day in the brush we had finished supper and looked forward to a fairly restful evening, preserving what remained of the day's bag and writing the all-important records that alone make museum specimens of value. Outside the door, however, we had found Put quietly awaiting our appearance, erect, smiling, his carbide light fastened to his uncovered head, his calabash with the water for the light over his shoulder, and a sadly-old muzzle-loading gun at his side. He quickly told us that his corn patch was over-run with rabbits and other four-footed robbers, and that if we would join him his *milpa* would be spared and we would get many specimens. Assured that the *milpa* was not far distant, we weighed the possibilities and decided to follow. Now a Maya does not know how to run well, but he walks with a purpose, and a forty-mile day to him is not a feat. And so it was; we went on and on, far too fast for hunting. At the end of two and a half hours we stopped a moment to catch our breath. My wife expressed the opinion that there was no *milpa*. I suggested return, for I knew several *milpas* much closer to our base, but Put became so dejected and insisted so that we were almost there, that we reluctantly went on.

The night was without moon or stars, the forest heavy. Our light was limited to the narrow beams of the headlights which followed our every glance. Focussed to a small point, so that we could see the shining eyes of a jaguar or any lesser night creature at the greatest distance, they were of slight service in defining the general lay of the jungle. A myriad of brilliant spots shone back at us. Most were but drops of water left from the daily rain. Almost as many, and far brighter, were green, yellow, or red spots that would occasionally be seen in pairs and make one's gun fly up. Cautious stalking would invariably, however, show but two tiny spiders standing close together. A few times we would see the black and yellow body of a big tarantula in the trail, with his legs spread out the width of my hand. His eyes, however, never shone. Had they done so, I've no doubt but that we would have sometimes shot at them for larger game. After three hours we came sharply to a bar across the path and there we were. A sweep of our lights showed the usual *milpa* picture of several thin, dead trees, a few tall, standing corn stalks, and a host of fallen, broken stalks, the whole densely clothed with morning glory and such other weeds as chose to grow there, unbothered by any cultivation. Here we advanced slowly, examining critically every reflection of our lights, but nothing furred or feathered met our gaze. A minute more carried us to the little thatched shelter in the clearing's center. Put went in first, signalling us to follow quietly. He pointed up into the thatch. We hoped for a 'possum at least, but a long black scorpion of which we had a hundred in our own roof back at Chichen, was all that was there. Disgusted, we started back home, though the boy wanted us to go on farther. By now our attention was too much dulled for us to hunt well and we went back without incident, seeing nothing but a bat which found hunting good in the path of our lights for the several minutes that it stayed with us.

We soon learned that hunting with an

Photograph by M. Roigneau

ON PARADE

The artisans of Chichen did not carve ordinary men. They chiseled images of their gods, their warriors and priests, elaborately dressed. This stone sculpture was done with hard stone tools. Traces of the original bright coloring of the reliefs may still be discerned

GUARDIANS OF THE NUNNERY AT UXMAL

Animals were favorite subjects for the sculptors that decorated the façades of Mayan buildings. Snakes, jaguars, iguanas, birds, and turtles occur most frequently. The animals shown above with their tails twisted are probably jaguars

Indian was good hunting but poor collecting. In spite of this, I one night persuaded Paquul after shaming him by doubting his courage—to show me where it was that a reputed *tigre* (jaguar) denned in a ruined temple. The trip this time was not long. We circled the tumbled mass of decorated stone, and, seeing no sign of the big cat, went down a twisting high-walled passage that led to rooms which the *tigre* was said to inhabit. We did see two big hornets' nests, for these cursed insects infest every ruin and every cave in Yucatan. If one is not cautious on entering, one is precipitous on leaving. The *tigre* was to be found in a den, dug in the floor of an inner room, reached by crawling on hands and knees through a small hole in the wall of another room. This we did; Paquul first, with a laudable courage—if one can credit his professed conviction that it was the *tigre's* den—and I right after, convinced that it was an unlikely place. An examination of the hole strengthened my belief that no jaguar ever bedded there. Two days later, in confirmation, a large steel trap set there secured a rat. Paquul's verdict was that the *tigre* must have moved.

Standing just outside this temple, I ran my light in all directions. No pairs of eyes that would indicate mammals showed themselves. My gaze came to rest on a single bright eye apparently of a spider, standing on a slender stem of a small bush. I watched this eye for some moments as it seemed of a different color than most spiders' eyes, and, unlike the latter, did not change its color with change in position. Then my light slowly delineated a small mouselike body, a sharp muzzle, a naked, curving tail. I recognized it then as a mouse opossum, most delicate and beautiful of all the furred creatures in the land, the first I'd ever seen. With recognition that it was a mammal, my gun instinctively flew up, but before my finger pulled the trigger the

gun came down, for in my right barrel there was buckshot and in the left a rabbit load. At that moment the "opossumlet" dropped to earth and could not again be shone. Though these animals are not rare in Yucatan, but five specimens are known from here, if one excepts a score of broken skulls which we recovered below the perches of those better hunters, the owls.

Bats react strangely to the light. Some little insect feeders fly up and down the beam of one's lamp in an annoying manner. There is no objection to the wings that sometimes brush one's face but, as one's eyes always are following the light's path and see only that which lies in that direction, the bat becomes an annoying distraction. One tree full of fruit bats that had congregated in the particular tree which seemed to suit them, became very alarmed at my light and flew down in a flock so that the air was full of them. It seemed to me, and may have been the case, that they wished to drive me away from the tree, but they made themselves too interesting to succeed. The eyes of these bats would not shine, and when they alighted in the tree it was invariably in a shadowed clump of leaves, so that I could never see them except on wing. For three nights they visited this tree and then, finding its store too near depleted, moved on to another unfound orchard.

The brush hides much life that one is likely never to see, but other species force their attention on one. In some sections cattle are raised and, whereas they themselves are no nuisance, they encourage the presence of Yucatan's worst pest—the garrapatitas—tiny brown ticks that hang in clusters from the plants, waiting for the passer-by. No clothing can entirely protect one from these all-pervading creatures that bite and leave burning little red spots where they stop. It is their specialty to dig into one's epidermis and no evening in the bush country is com-

A DOUBLE-HEADED CHACMOOL

Both human figures and jaguars were used for these ceremonial stones. This double-headed specimen is probably unique. In the back of the jaguar or at the navel of a human figure was a depression for the reception of incense

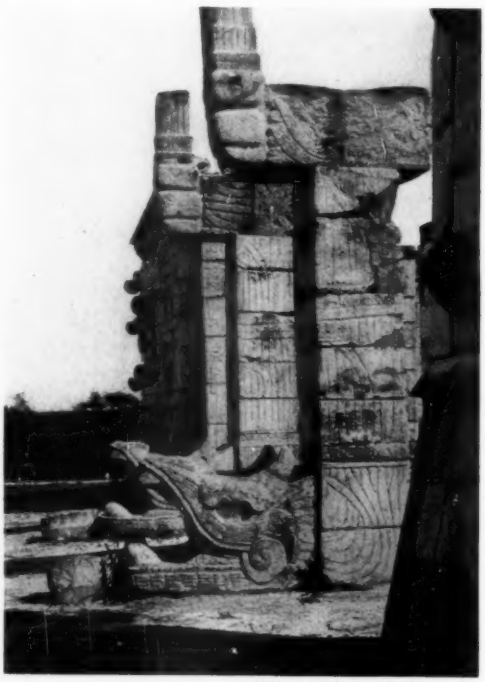
plete without a search for the day's unwanted catch. Neither gasoline, carbolic acid, nor alcohol will account for all of them. The Mayas, when out cutting wood, roll up their trousers above the knees, and keep switching their bare legs and smearing tobacco juice on their brown skin—men, women and children. And they seem as free of ticks as anyone.

Other like nuisances, too, abound. One of these which we shall long respect is a tree-living shovel-headed ant, whose bite is so powerful that on one occasion it virtually paralyzed my shooting arm for a full half-hour.

The greatest concentration of life occurs not where one would expect it—at a water hole,—but instead in the palm-thatched roofs that cover almost every Mayan domicile. From one such haven that sheltered us, we took two brilliantly red rats which previously were unknown. These rodents did not have this place to themselves, however. By day a few buzzards perching on the ridge waited expectantly for the unwanted portions of our catch. A dozen or two baby lizards found hunting good there. Hundreds of wasps and hundreds of little crablike spiders made this their home. Bloodthirsty praying mantises stalked and seized those which they could handle. This day population, though, was nothing to that which was revealed by night. Then it was that things dropped down around one's feet—huge, black bird-spiders, long scorpions finished off in black laquer, little red scorpions with a sting worse than that of their larger black cousins. A light swept over the surface of the thatch revealed as much life as is found in the sea. Gigantic flying cockroaches, crickets, geckos and bats. In such a room one is glad to have a canopy at night.

Though we saw little of it, Yucatan is not without its big game. The tapir is the largest and the rarest species. Bands of peccaries occur and once we even saw a semi-tame one fighting with the street-roving pigs of a small village.

Deer of two kinds are common; one a small white-tailed race, the other a species of the Central American brocket, which is even smaller than the white-tailed. Near the plantations the Indians hunt in bands of six or so, and such bands rarely come back empty-handed. Indians in the brush carry guns at all times, but it is only luck that brings them deer at such a time. It is estimated that 100,000 head are taken every year, half this number of hides being exported annually from the one port of Progreso.



Photograph by M. Roigneau

SACRED PLUMED SERPENTS AT THE DOORWAY OF THE TEMPLE OF THE WARRIORS

Yucatan is not a sportsman's paradise, but its vast, uncultivated brush breeds a great hoard of game to round out the little varied menu of the Mayas, and a far greater inedible fauna that will interest the inquisitive collector for a hundred years to come.

Chicago Academy of Sciences Photograph

Scant vegetation struggled against the drifting sand

THE PIPER OF THE DUNES

Photographic Glimpses of the Home Life of the Piping Plover on the Shores of Lake Michigan

By ALFRED M. BAILEY

Director, Chicago Academy of Sciences

Photographs by the Author

THE melodious call of a plover came faintly from over the wind-blown waste of sand. It was an eerie, gentle sound, barely audible above the wash of waves against the gravel beach. The long stretch of gray sand was cut at the horizon with a cloud-filled sky, and the blue waters of Lake Michigan rolled softly against the shores. Scant vegetation,—coarse beach grasses, struggled against the drifting sand, while beyond were more hardy growths holding back the shifting dunes.

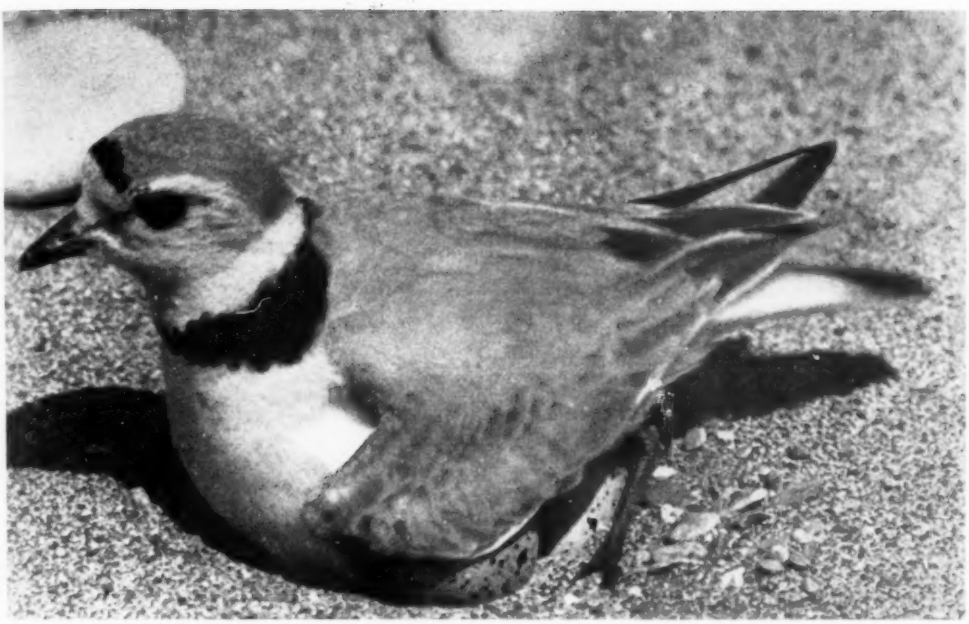
It was the voice of a piping plover, the hardy little bird which dwells upon the shores of ocean and lake. The friendly call had an anxious note, and as we stumbled across the soft surface of the beach, the small sand-colored bird scurried in a circle about us. As we walked slowly on, the musical note became more anxious, and with drooping wings and spread tail, the plover tried to lead us away. She fell on her breast and kicked sand with her feet, uttering piteous cries,—there was no doubt she was in great distress.

We stopped and scanned the shingled beach carefully. We did not want to step upon the eggs which we knew must be within a short distance. Small, flat, water-worn stones dotted the surface of the ground, and so protectively colored were the eggs, that we searched for half an hour without success, although we knew they were within thirty feet of us.

The anxious little bird was joined by its mate, and they took turns in their attempts to decoy us away. Finally, we resorted to strategy and concealed ourselves among the hummocks of drifted sand and watched the plovers through the glasses. Within a few moments the anxious calls were quieted, and once more we heard that musical voice which seems so much a part of the wind-whipped beaches. Then one of the birds jumped into the air, and on curved wing darted to the water's edge, where it fed uncon-

THE LITTLE PIPER OF THE DUNES REVEALED THE NESTING PLACE
One of the birds trotted across the sand and flat pebbles, paused, looked about, and then settled to the ground

A LARGE RESPONSIBILITY
The four sand-colored mottled eggs seemed too big for such a little bird to cover—the plover seemed scarcely larger than a sparrow



THE "PIPER" SETTLED UPON HER EGGS

She brooded contentedly, and grew quite tame as she became accustomed to the photographers, who benefited by her fearlessness

TWENTY-FOUR DAYS LATER

One of the old birds was guarding three lively gray- and white-coated downy youngsters, and one unhatched egg that still remained in the nest

OPERATING AN "EYEMO" IN THE SHELTER OF THE "BLIND"
The motion-picture machine portrayed the drifted beach and the plovers among the flat pebbles

cernedly along the wash, while the other, with scarcely any hesitation, trotted across the sand and flat pebbles, paused, looked about, and then settled to the ground.

We had found the nest of the little piper of the dunes! And what keen enjoyment we had when we watched the parents from a near-by photographic blind. The four sand-colored, mottled eggs seemed too large for such a little bird to cover—the plovers appeared scarcely larger than sparrows,—but the motion-picture machine was set up and portrayed the scene. We showed the cloud-filled sky and the drifted beach, with the plovers among the flat pebbles, and then the piper settling upon her eggs, where she brooded contentedly. She grew tame as she became accustomed to us, and we benefited by her fearlessness. The pictures tell the story.

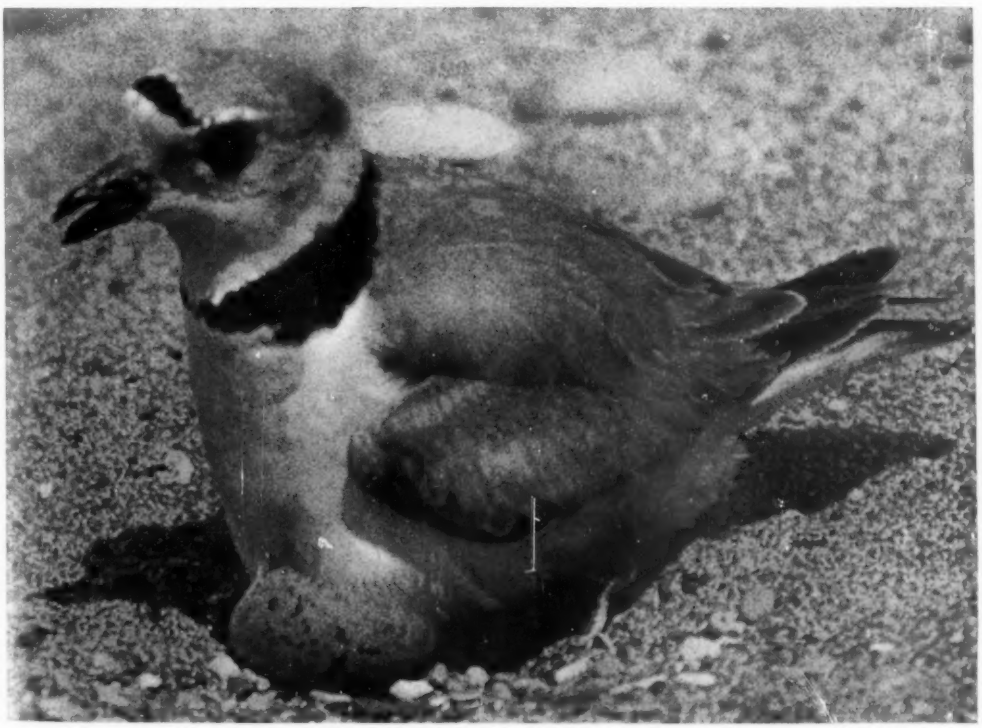
Two weeks more passed. We watched the nest for twenty-four days, and on every visit expected that the eggs would be hatched. The wild flowers of the dunes were blooming in profusion, and there was a constant change as the days rolled on. Fields of blue lupine, spiderwort, and phlox were common, and wild roses bloomed in abundance when we first found the nest, but they faded, and other beautiful plants, among them orchids, took their turn.

The waxlike yellow blossoms of the prickly pear were at their height when we made our last visit to the haunts of the piper. The old, familiar, gentle call came from across the waste, as before, and as we approached, the plovers tried to decoy us away. But we had grown impatient with their byplay, and made our way directly to the little cairn of pebbles which marked the nest. Up the beach scurried one of the pipers, while the other circled us with untiring persistence. One egg remained in the nest—the babies were gone. They were fifty yards away and going strong; one of the old ones led them, while the other remained to watch the unhatched egg. The fleet-footed and hardy-lunged youngsters were corralled after a spirited chase, and were replaced in the depression in the sand while the camera was

Chicago Academy of Sciences Photograph

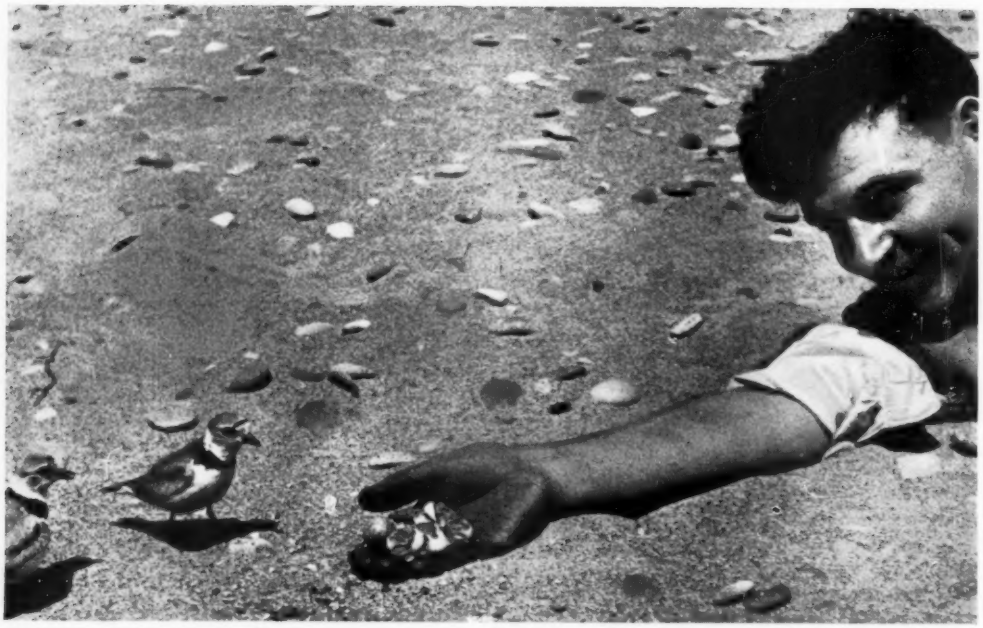
THE SHORE OF LAKE MICHIGAN

The long stretch of gray sand was cut at the horizon with a cloud-filled sky, and the blue waters of Lake Michigan rolled softly against the wind-blown shores



THE MALE PLOVER DID HIS SHARE OF THE INCUBATING

The old birds showed great solicitude for the remaining egg. They knew well that the hot sun would soon kill the unhatched baby, and one or the other parent was always hovering anxiously over it

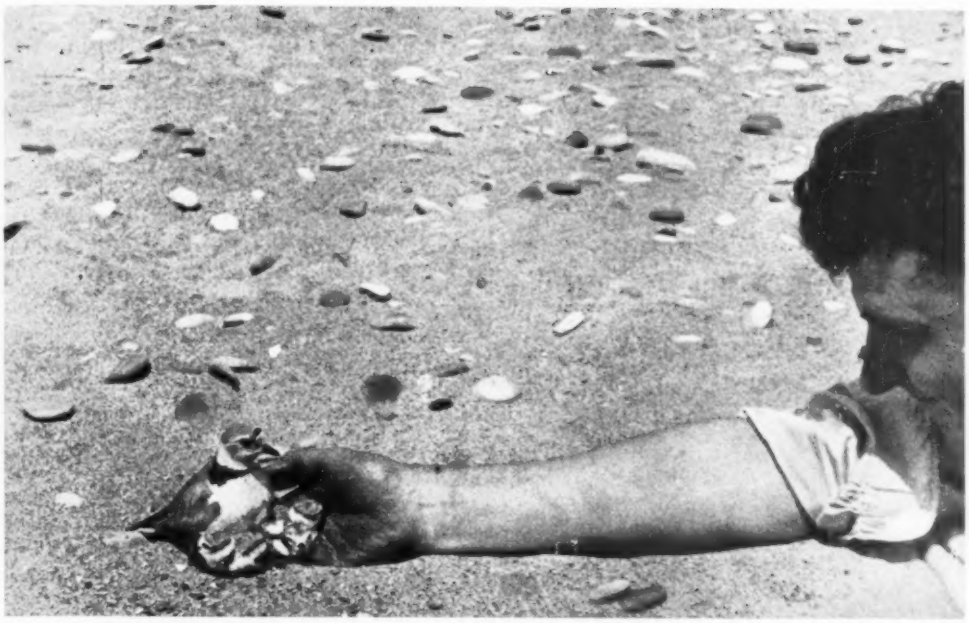


AN EXPERIMENT

Both plovers advanced timidly, and then the mother sidled up to the outstretched palm and with her beak rolled the egg upon the sand

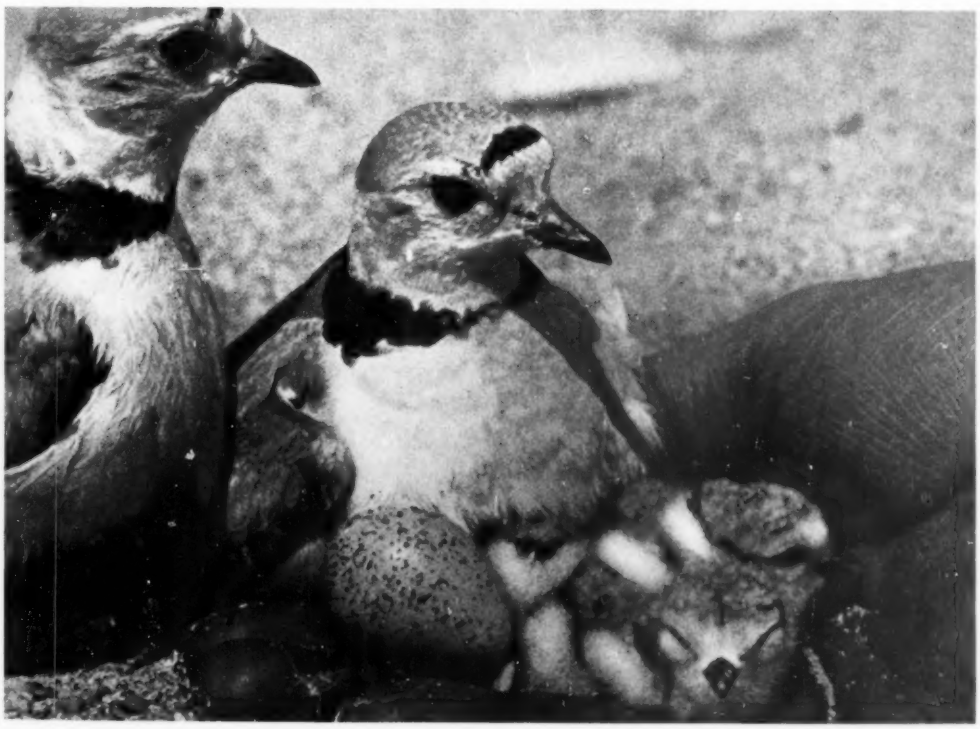
WHEN THE EGG WAS REPLACED

With scant hesitation the little plover stepped upon the hand and, with outstretched wings, hovered over the egg and young



AN EXAMPLE OF FEARLESSNESS

The motion-picture camera whirred merrily while the experiment continued, giving the photographers the thrill of a lifetime



THE FATHER BIRD DREW NEAR

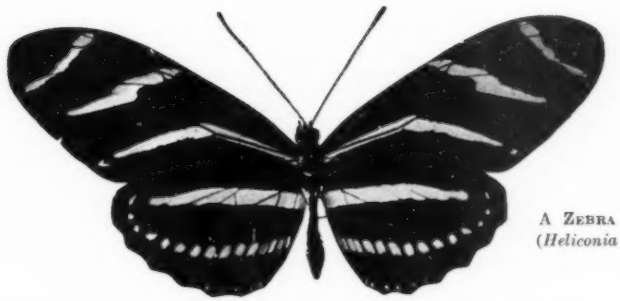
He crept alongside his mate, uttering low piping notes. With his breast he shoved her from her place and took his turn at brooding the young

made ready. When the gray-and-white coated downy babies were released, they acted like a miniature bomb. They ran in three directions, and kept going. They repeated the operation as many times as we cared to perform the experiment, and it was only after many attempts that we secured pictures of an old one with the youngsters. The precocious babies of the piper are well able to care for themselves.

One of the old ones showed great solicitude for the remaining egg. She knew well that the hot sun would soon kill the unhatched baby, and she hovered anxiously over it and called plaintively when we returned with the youngsters for another photographic attempt. She was so tame that we performed an experiment, and in return, we received the thrill of a lifetime. My companion stretched upon the sand, with the egg and youngsters in the palm of his hand. Deer flies settled upon various parts of his anatomy and thoroughly enjoyed our efforts at photography,—for he *had* to hold still. Both plovers advanced timidly, and then the mother sidled up to the outstretched palm, and with her beak rolled the egg upon the sand. The egg was replaced. Then, with scant hesitation, the little plover stepped upon the hand and, with outstretched wings, hovered over the egg and young. The motion-picture machine whirred merrily, —and the other plover drew near. He crept alongside his mate, uttering low, piping notes. With his breast he shoved her from her place and took his turn at brooding the young.

Further photography was useless. Never again would we try to photograph the piping plover, for never again would we meet such fearless little creatures as these. We folded our tripods and packed our cameras and then trudged back into the rolling hills, pausing only once to glance back where sand met sky and the waves of the lake washed ceaselessly. Again we heard the melodious call,—surely, we had had our day with the little piper of the dunes.

Chicago Academy of Sciences Photograph
WHERE SAND MEETS SKY



A Zebra Butterfly
(*Heliconia charithonia*)

THE SLEEPING HELICONIAS OF FLORIDA

A Biological Mystery in a Fascinating Setting

By FRANK MORTON JONES

The Royal Palm State Park, where the observations on the sleeping Heliconias were made, has already been described in Natural History *by Mr. H. F. Schwarz ("Swinging the Net in Southern Florida," July-August, 1923) and those who know the biological interest of that region hope that it may soon be part of a National Park including all of the nearly primeval subtropics that remains in our country. In connection with the nocturnal gatherings of the Heliconias, it may not be amiss to refer to another butterfly mystery, the assembly of the "monarchs" for their southern migration. A part of one such flock is shown at the entrance to the American Museum's Hall of Insect Life.*—The Editors.

IN the *Atlantic Monthly* for September, 1918, William Beebe gave one of his characteristically vivid and poetic word-pictures of tropical wild life, including a description of the sleeping habits of the Heliconia butterflies. Late one afternoon, in a little glade in the tropical forest bordering the "Convict Trail," he found two groups of Heliconias going to rest. One by one the butterflies alighted on the tips of projecting leafless twigs (two species in separate bushes), folded their wings, and slept—soon so soundly that Beebe was able to pick off one butterfly and then replace it upon its twig without awakening it or the others. All the sleeping butterflies faced northeast. Each had its own particular twig, to which after flight it always returned. When first discovered, sixty-three butterflies were counted, sleeping in the two bushes; three weeks later, "many of the twigs . . . were vacant, and most of the Heliconias were tattered and forlorn, just able to keep at their fluttering level"; and after two more weeks, only three butterflies flapped slowly in to their sleeping-bush from the darkening forest. One by one the others had perished, until only this remnant of the flock remained.

That these, the most "casual and irresponsible" of butterflies, should have a habit presupposing memory, sociability, caution,—for so Beebe interpreted his observations,—seemed to verge on the incredible; and this, doubtless was the reaction of most entomologists upon reading Beebe's paper; but forgotten in our literature are earlier records confirming and almost duplicating these observations.

In view of the fact that these sleeping-assemblages of Heliconia are almost unique in our knowledge of the lepidoptera, and that most of the published references to them are fragmentary and without pretence of prolonged observation, we welcomed the opportunity for closer study afforded by several visits to Royal Palm State Park, Dade County, Florida, covering the period between January 8 and April 6, throughout which these butterflies were always present and usually fairly abundant.

Throughout our first stay (in 1927),

A ROOSTING-PLACE FOR THE NIGHT
The newly-emerged Heliconia selects a dead branch with numerous twigs—often a branch with many dry, dead leaves—and returns to this spot nightly until opportunity occurs to join a sleeping group of its fellows

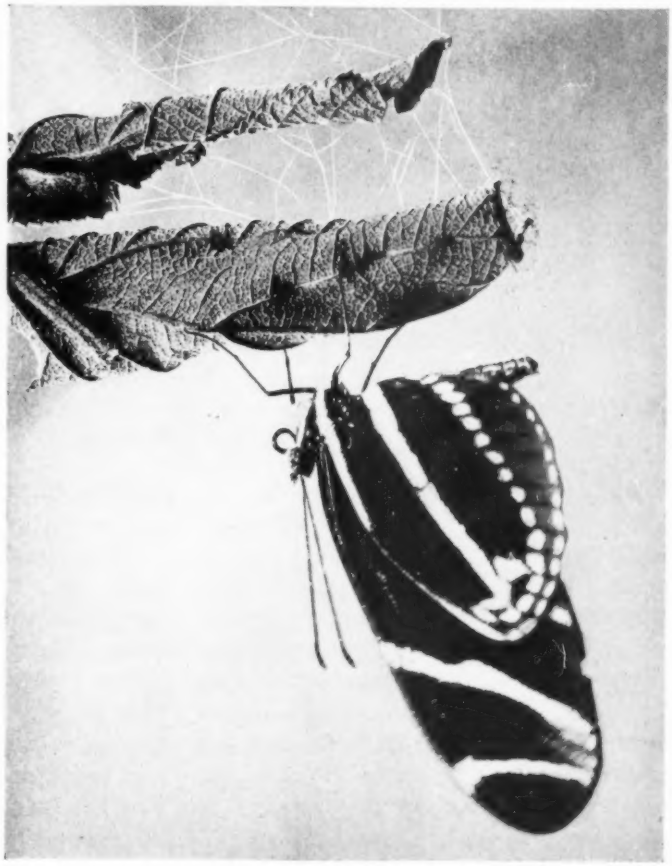
charithonia was seen every day, but its sleeping-assemblages were not then looked for or observed. It was noted, however, that the butterfly occurred in certain circumscribed areas, within which either singly or in pairs it might always be observed, though unrepresented in the intermediate areas. In the light of later observations, these frequented areas constitute the boundaries of customary flight on the part of distinct sleeping-groups whose components seem to keep within a few hundred feet of their sleeping-bush. Here, in characteristic slow-flapping wavering flight, these insects keep fairly close to the edge of thicket and jungle, to which they retreat when alarmed. Sometimes, with upright wings they feed upon flowers. Often they bask in the sun with wings outspread. If seen in pairs, one is usually in leisurely pursuit of the other, the second in flight following the leader in all its windings above and through the herbage, always maintaining the same short distance between the two, thus suggestive of the spaced flight of pelicans. This was not observed to be a mating flight, and Doctor Wittfeld's observations indicate that mating habitually takes place at the time of the emergence of the female from her pupa.

Upon our arrival at the Park in mid-March, 1929, the warden, Mr. W. D. Wheelock, immediately called our attention to a sleeping-assemblage of Heliconias in a dead and almost leafless bush standing at the edge of other and living herbage less than a hundred yards from the Lodge. He reported that in early January two such assemblages had been present, this one having persisted and absorbed the other, which had been located about a hundred feet distant on a swaying vine in an open-slatted nursery shed. In January, by his count, more than forty butterflies occupied the two roosts. As we observed them from mid-March into early April, between twenty and thirty were usually present, nightly, in the dead bush. Some of these were bright and fresh, apparently recent

emergences; others were tattered and worn and might well have been survivors from the January flock. We kept them under daily observation until our departure, April 6, making night and morning visits to the Heliconia roost, and (then) unsuccessful efforts to secure satisfactory photographs of the sleeping insects. Our longer stay in 1930 gave greater opportunity for observation, at earlier seasonal dates; and to avoid repetition we have consolidated our record of observations for the two years.

Of six observed roosting-places, three were at the edge of dense living herbage, in dead bushes or broken branches having many fine twigs; two were in pendulous vines, almost leafless but with twigs and interlaced ramifications; one was among the close-set wiry dead stalks and the bare aërial roots of a neglected fern-basket hanging in a slat-house. None was less than two feet or more than eight feet from the ground. Noise and proximity of buildings had no deterrent effect, for the roost longest in observed occupancy was almost in contact with a corrugated-iron shed in which a noisy engine and pump ran many hours of the night and day.

In the late afternoon, Heliconias, one by one, commence to drift in to the vicinity of the sleeping-bush. With devious slowness they explore the whole neighborhood, pausing here and there on some projecting bit of herbage, sometimes basking for a time in the last horizontal beams of sunlight, sometimes alighting on the roost only to leave it again for further exploring flight. About a populous roost, at sunset, the air is filled with butterflies in swirling flight, which continues in decreasing number of participants as one by one the flock finds a resting-place and hangs motionless in the sleeping posture. Up to almost full darkness, late comers continue to arrive, some apparently flying directly to the roost without preliminary exploring flight and joining the sleeping group; and more



AN EARLY MORNING PICTURE

(*Five minutes exposure*)

In its sleeping position Heliconia clings to its roost, head upward, its legs extended, its tongue partly uncoiled, and with its wings folded and pendulous

PLACE-MEMORY, SCENT, OR WHAT?
Heliconias on Roost B, after the substitution of new twigs. One has the tip of its wing obliquely clipped for identification

than once, after counting the sleepers at the last moment the fading light permitted, we have found that number increased upon visiting the roost at night. The frequently observed preliminary exploring flight, often exhibiting an unmistakably purposeful thoroughness, was at first attributed to a precaution against lurking danger before going to sleep—a gesture like looking under the bed for a burglar; but later observations suggest a more probable explanation.

For the ability of the Heliconias to find and identify their sleeping-bush, two explanations seem possible; this might be by place-memory, or by scent. We made two experiments which seem conclusive. In 1929 the flock of thirty butterflies occupied a few twigs of a large dead bush. One morning we cut out these few twigs, and tied them up in another bush about ten feet distant from their original location, and at the same height from the ground. The new location was not directly visible from the old one, but was within the usual radius of the preliminary exploring flight of the assembling flock. In the late afternoon we watched the behavior of the arriving butterflies. The usual performance of exploring flight about the roost was manifested. In this flight they coursed back and forth through the space formerly occupied by their roosting-twigs, and it seemed obvious to us that there was some recognition of change. In their wider flight, several butterflies paused upon the old twigs in their new position, only to leave them again and rejoin the flying group. Gradually the flock came to rest upon twigs in the old roosting-bush, close to the vacant space left by the removal of the roost itself. After dark, twenty-seven butterflies were found sleeping on these new twigs, and one, alone, on the transferred twigs ten feet away. Next night, this one rejoined its fellows in the old bush.

Our next experiment, made in February, 1930, even more clearly indicated that recognition of the roost is by place-memory, not by scent. In preparing for a flash-light photograph of the strongest

group then under observation, we had attempted, in the daytime, some rearrangement of the twigs of the roost. In this attempt, so many dry leaves and brittle twigs fell off, that we feared we had ruined the roost for further occupancy. As a last and not very hopeful effort, we cut away all the remaining branches of the roost and brought others from a distant brush-heap, tying them into place as nearly as possible in the old site. At dusk, without any obvious hesitation the butterflies accepted this substitution, and that night they slept upon the new twigs in the usual numbers. The roost-location, and not an imparted odor, identified the sleeping-place.

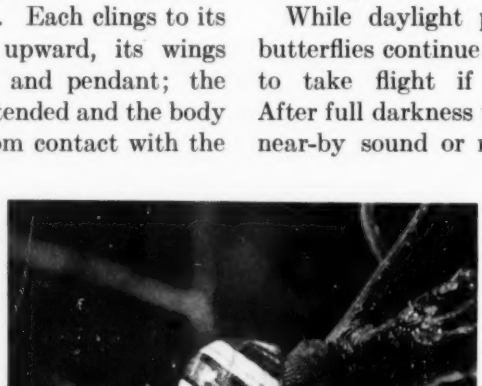
PROTECTIVELY PATTERNED

Five sleeping Heliconias. In color and outline their longitudinal stripes merge into the dry roots and stalks of their roost

Mr. Beebe noted that individual butterflies, recognizable by tears or imperfections in their wings, occupied the same twigs night after night, and he believed that each insect had its own particular twig to which it always repaired for sleep. In 1929, by rough drawings of the furcations of the twigs of the roost and by note of the number of butterflies resting on each, we determined that some nightly shift in the relative positions of the sleeping insects usually takes place. We then discovered that the butterflies could easily be marked for identification by snipping pieces from their wings while they slept. Memorandum was then made of the twigs occupied by insects thus variously marked for individual identification, and night after night their position on the roost was determined and recorded. Many of them *did* occupy the same twig for a short succession of nights. Usually some of the marked butterflies occupied new positions. None maintained the same position for many successive nights, and some of the shifts of position were from one side of the roost to the other, from night to night. That is, there was some evidence that place-memory is definite enough to extend to the location of individual twigs, but abundant evidence that continuous occupancy of them is far from the general rule.

Unless alarmed, or unless the crowding of later arrivals occasions some readjustment of position, each butterfly after

assuming its sleeping posture upon the roost usually remains there motionless throughout the night. Each clings to its twig or leaf, head upward, its wings closed over its back and pendant; the legs are somewhat extended and the body is thus held away from contact with the support; the abdomen is hidden within the margin of the hind wings; the antennæ are held straight and erect, slightly divergent, and almost parallel with the costa of the front wings; the tongue is partially uncoiled, forming an open circle of about one-eighth inch diameter, its inner rim often bearing an adherent droplet (sometimes a hardened globule) of nectar (?).



A TROPICAL TREE-SNAIL
In warm, humid weather brightly colored tropical tree-snails creep out from their hiding places in the jungle at Royal Palm State Park

The sleeping flock usually forms a fairly compact group in which twenty or thirty butterflies may be crowded together within a radius of twelve or fifteen inches, sometimes with little outlying groups on adjacent branches or twigs. In these sleeping-assemblages most of the Heliconias face the same way. In attempting to photograph such a group, however, it is often found that a position chosen to secure a broadside picture of the group includes some individuals which present an edgewise view to the camera. Nor do different flocks all face toward the same point of the compass, and one whole flock was observed to reverse its position from one night to the next, perhaps because some change had been made in the adjacent herbage, incident to photographing the group. We believe that the position of the twigs or leaves composing the roost is one determining factor, and that the direction of strongest light has some orienting influence.

While daylight persists, the roosting butterflies continue to be alert and ready to take flight if closely approached. After full darkness they seem unaware of near-by sound or movement, and even brilliant lights unless very close elicit no response. A jarring touch of the supporting twigs or a brilliant light held within a few inches of the roost arouses them; and even if none takes flight, antennæ are waved, feet are shifted uneasily, often the palpi are alternately spread apart and closed, exhibiting conspicuously their pale inner surfaces.

At night, by careful handling, one after another of the sleeping butterflies may be picked off from the group, even sometimes replaced again, without awakening the rest; but never did we succeed in picking off the whole flock without arousing some remnant of them into flight. When violently awakened, the whole flock literally *explodes* into flight in all directions; and although brilliant light exerts a weak attraction to some, most of the members of the flock cling to the first object into which they bump, and in the morning may be found hanging to adjacent herbage within twenty or thirty feet of the roost.

The morning awakening and departure of the Heliconias was repeatedly observed. This may be considered a typical record: March 22, evening, 24 Heliconias sleeping in roost; March 23, 6 A.M., all still asleep; 6.15, one flew slowly away while the light was still too dim for its ready

detection as it slipped off into the shadows of the jungle; 6.22, one sat slowly flapping for a few seconds then flew off, followed quickly by another which had given no preliminary signs of approaching flight; 6.35, one departing butterfly bumped into the remaining assemblage, which exploded into flight and immediately dispersed. On other mornings, this explosive flight of the entire flock would be the response to our approach, however cautious.

On cool and cloudy mornings the night's lethargy persists until later in the day, often permitting incautious approach, and continuing until nine o'clock, or even later in time of heavy rain. After repeatedly witnessing the prolonged exploration of the roost neighborhood as a preliminary to assemblage on the roost, and these explosive departures in the morning or at the approach of danger, we concluded that the evening flight is one of orientation, by which place-memory is established and maintained—the sudden departure at dispersal of the flock affording no opportunity for this function.

THE STRANGLING FIG
It hangs from many of the trees of the Hammock as a ropelike vine

THE STRUGGLE FOR SUPREMACY
The Fig vine thickens, and tightens its strangling grip, until the supporting tree is completely enveloped

Upon our arrival at the Park, March 18, 1929, we were shown a group of sleeping Heliconias upon a roost which had been in uninterrupted nightly occupancy since early January. It was still being used at the time of our departure, April 6. That is, this site had been in uninterrupted use for three months, and beyond this period we did not know its beginning or end.

In late September, 1929, a hurricane whipped most of the leaves from the trees at the Park, flooded the country to an almost unprecedented degree, and created conditions most unfavorable to insect life and abundance. The warden, Mr. Wheelock, wrote us that some of the

Heliconias had survived the hurricane and that they were in daily flight about the Lodge. Later, however, their numbers decreased, and on December 3 Mr. Wheelock wrote, "There is not a single Heliconia left." He predicted their return in January, when usually they become more abundant. We arrived at the Lodge on January 8, and on the next day saw a bright freshly-emerged Heliconia at the edge of the jungle. Thereafter we saw one or two each day, but not until the 20th did we succeed in locating a sleeping Heliconia. It slept alone, in a pendent leafless vine; the next night it slept in the same spot; the third night it did not reappear. On February 2 we located another, sleeping alone on a bare fern-stalk; for two more nights it slept there, then it, too, did not reappear. Meanwhile, however, we found three other roosts, all within one hundred yards of the Lodge and of each other, and each with several occupants. For our records we designated these roosts B, C, and D, and in each group we marked some of the individuals for identification. To our surprise, we discovered that there was a constant shift and interchange, from one sleeping-place to another. For example, a marked butterfly which we identified by a single oblique clip from its front wings, was located, sleeping, on twenty-two out of twenty-six consecutive nights; and in this period it made eight changes, back and forth, between roost B and roost C. Its longest observed unbroken stay on one roost was for six successive nights. This explained the previously-observed fluctuations in the numbers present on a roost from night to night, and relieved the Heliconias of the suspicion we had formed, that they frequently stayed out all night; but for that suspicion it seems to have substituted the certainty that some of them maintain two establishments.

One other significant experiment seems worth recording. On February 8 a motor trip was made down the Cape Sable road

THE FINAL STAGE OF THE STRANGLING FIG

Long after the supporting tree has crumbled away, the Fig itself becomes a great tree, whose braced and buttressed roots give independent firm supports

to West Lake and beyond—a distance of twenty-seven miles from the Lodge. Here, over a limited area, Heliconias were found flying in some abundance. Two were captured uninjured, transported to the Lodge, marked with conspicuous and unmistakable wing-clippings, and released. One was never seen again. The first night after its release, the other one was found sleeping on roost B; and for eight of the succeeding eleven nights it was identified among the sleepers on either roost B or roost C, in that period making three shifts between these roosts.

It is thus apparent that individual Heliconias sleeping alone develop a place-memory which may persist for a number of nights; that a "capacity for sociability," as Beebe expresses it, may become a stronger stimulus, to which the original place-memory is subordinated; and it may well be that in these observed shifts from roost to roost we are witnessing the chance operation of this social stimulus, rather than the apparent ability to remember and recognize several successive sleeping-sites.

SWAMP LILIES

The glades are not always monotonous expanses of saw-grass, for they maintain a varied though limited flora. Here and there they are starred with the great snowy flowers of *Crinum*

Has the group-sleeping habit of the Heliconias any determinable significance of importance to the species? Of the three primary requisites for continuance—food, safety, progeny—it would seem that we might at once eliminate one—food—as having no conceivable relation to this habit. Nor could we find evidence that it has to do with the mating of the sexes. The populous roost under observation in March and April, 1929, included both sexes in numbers not greatly unequal; but as we observed the formation of new assemblages in 1930, a different condition was found to exist. All the insects we noticed first, roosting alone, were males. The small assemblages beginning in late January were composed exclusively of males, and all Heliconias netted by day were males, which obviously have an earlier seasonal emergence. It was not until almost a month from the observed formation of the sleeping groups, that any females were detected among the sleepers or captured in flight. We could detect no differences of behavior among the insects of the bachelor groups, in comparison with those of the mixed assemblages; and Doctor Wittfeld's detailed observations in regard to the assemblage of males of *charithonia* about

the pupæ of females several days before the emergence of the adults, render it even less probable that the sleeping-assemblages relate in any way to the union of the sexes. Do they then contribute toward the *safety* of the species?

As these butterflies cling motionless upon the roost, with folded wings showing only the dulled colors of their under surfaces, the sleeping group is not to our eyes conspicuous. Repeatedly we have approached a roost and believed it to be bare of occupants, until gradually our eyes picked out from the confused mass of narrowly-striped wings and sun-bleached twigs the form of one butterfly after another, and finally the whole group became visible to us. But even if protectively colored—or rather, patterned—why should thirty such butterflies sleeping in a compact group be any safer than thirty sleeping singly and far apart? The reverse would seem nearer the truth.

To this query the behavior of one butterfly, plucked from the sleeping group and held between finger and thumb for inspection, may give a clew. It waves its legs and antennæ, it curves its body out from the concealment of its wings, crescent-formed, and holds it rigid; and from the end of the abdomen it pushes out a rounded, yellow, glandular mass (in the male, double) from which is given off a powerful odor and in some instances a minute drop of fluid. Perhaps we should say perfume, rather than odor, for to our senses it seems flower-like though rank, suggesting the rank sweetness of the Datura blossom. We could detect no difference in scent between that of the male and the female butterfly.

The Heliconias are foremost among classic examples of the theory of "warning coloration"—of the possession of conspicuous easily-recognized colors and patterns (usually yellow, orange, or red, and black) by which their inedibility, through the possession of a nauseous smell or taste or of special means of defense, is advertised to their enemies. A great controversial literature has been built up about them and about this theory. Their behavior by day is not incompatible with this theory; for the "zebra" butterflies, slow of flight, seem to advertise their presence and identity, rather than attempt to elude observation. If Heliconia is protected by a nauseous odor or taste, advertised to its daytime enemies by conspicuous readily-recognized colors and color-patterns, *then* its degree of protection, at night, when these warnings are not so apparent, may be increased by the close proximity of large numbers, under these conditions readily recognizable by form, color, or *scent*, as identical in kind and inedible; for thus the injury or destruction of one of the group might conceivably work for the protection of the many.

A recent and able paper on the sounds produced by insects concludes with the query, "Do they serve a really important purpose in the lives of the insects? If not, why have they developed and how?" Perhaps the sleeping-assemblages of Heliconia are of no real importance in the economy of these insects. On the assumption that they are of significance, we have presented a suggested explanation which seems in agreement with the observed phenomena; and for this suggestion we have been unable to discover any reasonable alternative.

LOOKING THROUGH THE FRINGE OF PALMS ON THE BAY OF ANTONGIL

BEVATO

A CAMP IN MADAGASCAR

Experiences of a Collector in an Island Forest

BY RICHARD ARCHBOLD

Through the generosity of the late Mr. John F. Archbold, the American Museum of Natural History was enabled to participate in an expedition to Madagascar in 1929 and 1930 for the purpose of collecting birds, mammals, and fossils from this important region. The expedition was organized by Dr. Leonard C. Sanford, and sent out in coöperation with the Paris Museum and the British Museum. The director of the expedition was Mr. Jean Delacour, and the American members were Messrs. A. L. Rand, Richard Archbold, J. C. Greenway, Jr., and Philip DuMont. An important collection was made which will be divided among the three participating institutions.—THE EDITORS.

TWO hundred and fifty miles across the Mozambique Channel from Portuguese East Africa lies Madagascar, one of the three largest islands in the world. Possessing a fauna almost totally different from the huge continent so near which it is located, with no big game—with no indigenous mammal larger than the wild pig (*Potomochaerus larvatus*)—it is nevertheless the former habitat of the giant and only recently extinct *Epiornis*, the huge bird that is now found as a sub-fossil throughout the island and may possibly have served as the original from which the fabled roc of the *Arabian Nights* was developed by the imaginations of the East. Furthermore, it is the only place where that curious little animal called the tenrec is found—the animal that forms a staple food for some of the wilder tribes of Malgach.

Known to the old whalers of New Bedford and Nantucket, colonized by the French, almost on a direct line between the Cape of Good Hope and India, Madagascar still seems to remain detached from the rest of the world—seldom visited, little known to the world of Europe and America. A thousand miles in length from north to south—three hundred and fifty miles across at its widest point—containing mountains and tropical valleys, great rivers and broad plains, this island of the Indian Ocean lies for the most part beneath the tropic sun, barely thrusting its southern end across the Tropic of

Photograph by Brown Bros.

A TYPICAL WEST COAST VILLAGE

Native Madagascar homes vary considerably according to their location. In the interior of the island they are made of dried clay with a roof of branches and thatch. The forest dwellers and coastal tribes build houses with bamboo walls perched on piles

Capricorn into the South Temperate Zone, though this part, containing the deserts of the island, is the hottest portion of the entire land mass.

For a year the "Mission Zoologique Franco-Anglo-Americaine" had been collecting in the south and central parts of the island. We then, to continue the systematic study of its fauna, moved to the head of Antongil Bay, which lies far to the north on the island's east coast, and from this point we planned to penetrate by motorboat and native dugout canoes, or *lakanas*, into the interior where, even from Maroantsetra a town on Antongil Bay, we could see the towering mountains that climbed up and up to the north of us to reach their climax in the great massif of Tsaratanana, which lies within about 150 miles of the island's northernmost tip.

Even the most casual glance at a map of Madagascar shows plainly one of its striking physical features, for the eastern coast, a thousand miles in length, is strangely straight and unbroken. In addition to this there is a very strong current that strikes the coast and blocks with shifting bars of sand the mouths of all the rivers and any but the largest harbors. The only major indentations in this coast line are Antongil Bay, and, still farther to the north, the bays of Loquez and Diego Suarez, the last of these undoubtedly one of the finest of all the world's fine harbors.

We, however, were headed away from the coast, into the hilly interior, toward where, on our western horizon, the mountains rose abruptly in softly rounded outlines, beyond the forest of the coastal lowlands.

The sand banks at the mouths of all the east coast rivers make navigation difficult

or impossible, and Maroantsetra River is one of the few that one can navigate at all. In order, however, to get to the motorboat that had been lent to us through the generosity of the head of a local lumber concession, we had to load our ton or so of equipment into a *lakana,* paddle across to a sand spit, and carry our belongings to where the boat was waiting in navigable water.

THE FOREST AT BEVATO

This shows the cut-over forest with its entanglements of vines. A native guide is standing in the lumber path through which the *lakanas* pass en route to the river

Mr. A. L. Rand, Mr. Philip DuMont, and I, with two natives, made up the expedition party, but with the crew of the motorboat, who were all Malgach, there were ten of us when, uncomfortable and chilly in the rain, we finally managed to stow our belongings and get under way.

For a time after we had started upstream the river wandered through low country covered with swamps of traveler's trees, their fanlike tops spreading wide from their tall slender trunks. Until about noon we wound along the smoothly flowing river, conscious now and then of the flash of a large white heron (*Casmeroides albus*) as it flew up along the bank. Often we saw flocks of paddy birds (*Bulbicus ibis*) as they arose and circled about. A purple heron (*Pyrrperoidia purpurea*) flew over, and Rand brought it down to add to our collection.

Native *lakana* passed us frequently, and our motorboat crew, with a far-fetched idea of humor, would run close to these unseaworthy craft and enjoy the havoc created by our wake. Most of the natives of the interior are very poor seamen and many of them are actually afraid of the water, with the result that near panic was sometimes created, though our own crew roared with

Photograph by Brown Bros.

NATIVES OF TANALA

The population of Madagascar is Negroid with an element of Malay

Photograph by Brown Bros.

MADAGASCAR PORTERS

The carrying method illustrated here is reminiscent of Polynesia. Note the pareu-like costume which consists of a length of cloth wrapped around the waist

laughter at these narrowly averted mishaps.

We passed at last from the lower country of the coast into the more hilly section. The transition was abrupt, and the scenery changed at once. The hills that came down to the river were forest-clad and steep, their sides rising sharply from the banks to support dense growths of hard wood, among which, farther upstream, the natives find the trees from which they make their *lakanas*. Near the waterways suitable trees are scarce because of the ruthless destruction of the forests, and the native who decides to make a canoe must these days go far afield in search of proper trees.

After a suitable tree is located, it is promptly felled so as to lie in a level position. If the hill is especially steep, a platform is built on which the workmen labor. The *lakana* is roughly cut and gouged out with axes. It is then light enough to be dragged to the nearest stream, which may be two or three miles away. The forest growth being heavy, a pathway must be cut and along this specially constructed way the canoe is hauled by a score of men. When this rough hull has reached the water's edge the finishing touches are put on, but this is always done by the local chief himself.

This method of procedure is, naturally enough, very destructive of the forest, for in the process of making the platforms and clearing the paths, great gaps are cut in the forest, where tangles of vines quickly spring up, and choke the young trees that are just starting to grow.

Thirty kilometers from Maroantsetra, where the low country changes so abruptly into hills, we stopped at a tiny village which consisted of three stores, one of which was run by an Indian. Upon investigation we found that the second was operated by a Chinese, while the third

A MOUSE LEMUR
This lemur (genus *Microcebus*) lives entirely in the traveler's trees on the fruits of which it feeds. It is nocturnal and aestivates during the time the tree does not bear fruit

merchant, judging from the crowd outside his emporium, was undoubtedly Malgach. There were no Europeans in the village, and our *bhoto*, or native servant, was sent to purchase supplies of rice and sugar. The stores contained little except bolts of cheap European cloth and a few simple tools such as knives and the curious native axes. We had been told that we would be able to purchase bread and almost any supplies that we would want, but that "information" proved to be incorrect.

We started upstream again, and DuMont, seeing a swallow (*Phiclenia barbonia madagascariensis*) as it swept across the stream, brought it down with a fine shot. The helmsman immediately turned the boat in order to pick up the fallen bird, but the mechanic whose duty it was to stop the engine, forgot his task in an effort to recover the specimen, with the result that the boat rammed the bank at full speed and we had some difficulty in getting off again. Even when we did, one of the boatmen, who had been pushing against the bank with an oar, forgot to maintain his hold upon it, and left it sticking in the mud. Such a loss was, of course, not to be permitted, so the guilty boatman was forced to swim ashore to recover it while we waited in deeper water.

About six kilometers above the village at which we had made our purchases, the motorboat was forced to stop because of shallow water, and it was necessary to obtain *lakanas* in which to continue our journey upstream. We had not previously made arrangements for them with the result that the boatmen disappeared into the forest in search of natives from whom *lakanas* could be obtained. Within an hour our boatman reappeared with three *lakanas* which were, unfortunately, too

AN EXPEDITION PET
One of the species of lemur collected in Madagascar by the expedition

A VIEW IN THE COASTAL FOREST
The forests of Madagascar contain many valuable timber trees and the characteristic traveler's tree, whose leaves contain quantities of clear watery sap which affords a refreshing drink

small for all our luggage and ourselves. The result was that we loaded what we could (most of it, fortunately), and one or two porters followed up the banks with what remained.

Bevato, the camp for which we were heading, lay on the crest of a small ridge about four kilometers above the point at which we had been forced to leave the motorboat, and when we reached it we found that it consisted of three houses connected by porches. Bevato gets its name from the Malgach words, *be*, meaning large or big, and *vato*, stone or rock. The meaning of Bevato, consequently, is "big stones." The smallest of the three structures at the camp was the cook house, which contained a stove of the type found throughout Madagascar—that is, a box of sand—though this one had the innovation of being raised on legs. No chimney was attached, however, and the smoke made its escape through the door. Our dining room, which was next to the kitchen, was a palatial affair, having three large doors and a window instead of the usual single low door that forces one to stoop. The third, and largest, of our houses was divided by a partition and in one half of this we put our beds, while in the other half we stored our belongings and arranged a workroom. All the buildings were raised from the ground on stilts in the manner common in the interior of the island, though we boasted board floors while the usual structures have floors of reeds.

The construction of these houses was similar to that used by the natives in that the framework was first erected and then the walls were covered with mats made of the ribs of the leaves of the traveler's tree. These mats are simply made by running slender sticks through the ribs until a section four or five feet square or even more is completed, and these are tied on the frame work with sisal or vines. The roofs are made of the dried leaves from the same kind of tree and are usually put on to a thickness of a couple of feet.

All about us spread the forest, with narrow trails leading here and there over the steep clay hills. Below us a native village lay hidden by a row of banana trees. The weather was perfect for several days after our arrival, and the place was really beautiful.

One of the frequently heard noises comes from the babakoto (*Indris breva-*

caudatus) the largest of the lemurs. This animal, if it could straighten out its legs, would stand not quite five feet in height. Its coloring is black, gray, and with a little brownish-red, in varying proportions, and its tail is only rudimentary. It is the only species of the genus, and we were especially interested in it.

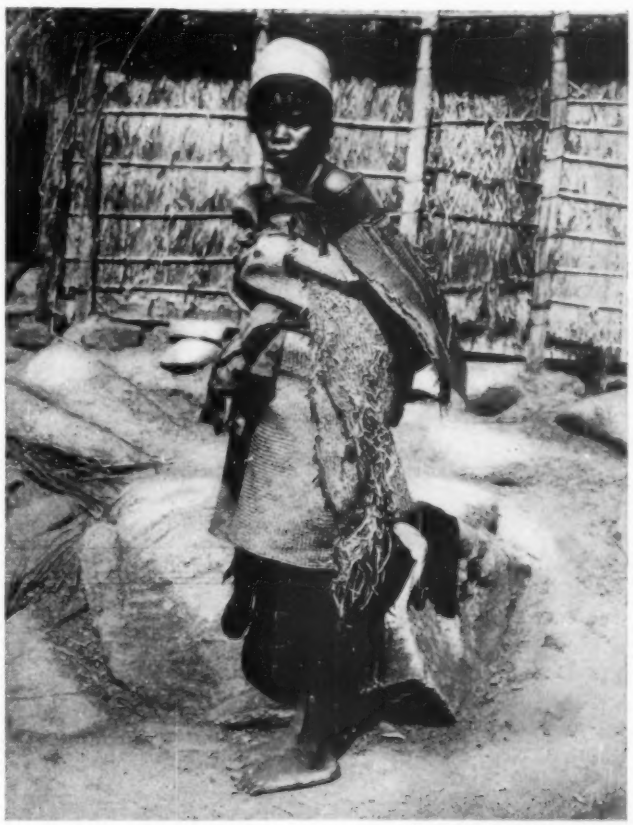
Many times I have listened to the weird howling of these animals. Sometimes the calls were plaintive and almost human, reminding one of a crying child as they echoed through the woods. I have often wondered whether the cries were warnings, or if they were, in some wild way, a means of communication, for they were usually answered from some distant hill. The cries are made up of both long and short notes and it is very noticeable to the person who listens closely that these vary in their arrangement, although they seem to be kept to the same two tones.

I have often turned to my porter when these cries were ringing through the forest, to ask "*Isy lavitra*" (Is it far?) and he would invariably nod in the affirmative.

More than once I doubted the fellow's nod, and set out to approach the calling lemur, but always, after stumbling up and down the steep clay hills until I was exhausted or had lost my way, the cries would seem to be as far away as ever. Not until the last day of our stay did I succeed in seeing one of the beasts, and even then he saw me first and was off through the valley trees in a series of tremendous leaps that made pursuit futile.

The weather changed for the worse, and hunting from the camp became daily more difficult. The hills were steep and under the continual rain their clay sides became more and more impassable, and yet our collection grew rapidly.

Every evening the vara-coha (*Lemur variegatus*) and the vara-mena (*Lemur fulvus*) would add their quarrelsome cries to the sounds of the forest. These creatures usually travel in groups of from four to eight, and are by far the most abundant of the lemurs. They are not harmful, save as, now and then, they make a raid on some of the natives' banana groves, but such raids are not often successful, for the animals seem to be utterly unable to feed



Photograph by Brown Bros.

A COUNTRY GIRL

Vegetable fibers of all kinds are skilfully woven by the women into cloth for clothing, mats, and baskets, some of much fineness and delicacy, and often with much taste in color

without engaging in noisiy quarreling.

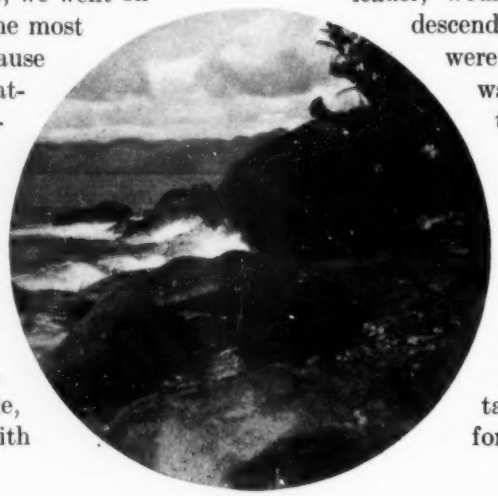
Almost every trail through the forest was dotted with snares, and the careless walker along those woodland ways might, almost at any moment, step into one of the traps. Returning from one of my unsuccessful forays after a howling *Indris*, I suddenly found myself flying down hill head first. I scrambled to my feet and looked questioningly at my guide, while he in turn pointed to a snare I had not seen. It was a bent sapling and a loop of line so arranged that, upon releasing its catch, the sapling sprang up, drawing the noose around whatever part of the animal was inside and lifting him clear of the ground.

For two weeks the weather remained cloudy and rainy, handicapping us and making us a little uncomfortable, when we were on the trail. But during the week preceding our return downstream, the weather turned fine again. Our morning hunting became easier, and we made it a practice to work in the afternoon outdoors in the shade of the house, often moving our table and chairs as sunset came, in order to watch the changing colors on the ranges of mountains, and in the valleys between.

Now and again, too, we went on night hunts—to me the most interesting of all because of the mystery that attends one in the darkness of the tropical forest. There are so many strange sounds at night—frogs that fool one with their excellent imitations of lemur cries—other frogs that seem to explode, now and then, with a sound that is an almost perfect imitation of the bang of a gun. Strange insect sounds come from all about. Sounds that seem to defy explanation whisper through the trees. And even when one shoots at shining targets at night there is usually a mystery as to what the prize may be, for one can rarely be sure exactly what the two balls of fire are; sometimes they are only a pair of stars.

The spell of fine weather which made our final week in camp much easier, turned out to be not entirely an unalloyed blessing, for, owing to the lack of rain, the motorboat that came for us could not travel so far upstream as it had done when we arrived, and even where it floated, the water was so shallow that we could not load all our baggage aboard, but had to put most of it into a large *lakana* that had been sent up at the same time through the kind forethought of the lumberman who supplied our motorboat.

On our way downstream, as we rounded a bend at sunset, we came upon a flock of paddy birds. They were flying low over the water and gave the impression of rows of brilliantly white waves. As they passed us, each row, in obedience to its leader, would rise and then descend until their wings were almost touching the water. We watched them as they passed and left them to dance in the sunset as we rounded another bend. Aided by the current we sped onward toward the coast, having obtained the collection for which we had come.



A BIT OF MADAGASCAR COAST

TAILS

Caudal Appendages Adapted by Nature to the Needs of Her Creatures

By CHARLES E. BURT
Department of Herpetology, American Museum

The raccoon's tail am ringed all 'round; the 'possum's tail am bare;
The rabbit's got no tail at all; but the white spot's always there.
—NEGRO FOLKLORE

LET us trace, in a general way, the development or formation of the tail in the animal kingdom. One of the simplest and most generalized animals known, the minute, one-celled *Amœba proteus*, is without constant body form. Therefore, there is no tail, just as there can be no head, no mouth, no eyes, no ears, and no legs—the mass of living substance or protoplasm constituting the species serving as all of these and more. In many other simple one-celled forms, however, the body is constant in outline and, in addition, in many of them one part of the body is always behind and another is always in front as the organism moves about. Here we find *longitudinal orientation* of the protoplasmic mass which constitutes the body and hence, as regards the tail, the foreshadowing of future developments.

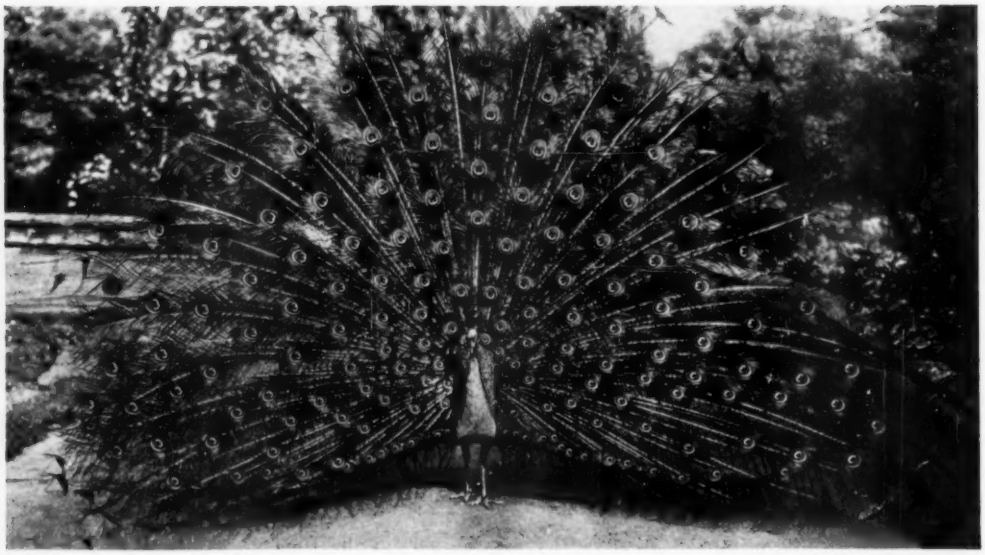
Photograph by Herbert Lang

Monkeys of the New World belonging to the family Cebidæ nearly all have prehensile tails, wheras those of the Old World do not. Above is a picture of an African monkey; the one shown below is Central American

Photograph by Frank M. Chapman

The free-living, freshwater flatworm *Planaria*, a larger, more advanced, many-celled animal, offers a very perplexing problem when we attempt to divide it into general sections or parts according to the popular method. This curious organism is always cross-eyed, if its tiny "eye-spots" are really to be regarded as eyes, and its mouth is situated near the middle of the body. Now, if we consider the fore part of the animal as the head, including the mouth as usual, we find that most of the planarian is head, but if we regard the portion back from the "ears" or sensory lobes as tail, much of this head really proves to be something else. Thus, at this point we are still unable to positively separate head, body, and tail.

This same indefinite condition or status of the tail holds to a greater or lesser degree throughout the lower or invertebrate series of animal groups, although it is true that certan of these show caudal developments which are worthy of note. The crayfish has a series of five terminal plates which the animal often uses in swimming rapidly backward through the water. Numerous insects, such as the cricket, have conspicuous posterior hairs or filaments which some may regard as a tail. Bees have developed a strong sting behind. Scorpions, which also sting with



Photograph by Arthur Fisher

THE PEACOCK'S FAN

The animal kingdom holds no more elaborate tail than that of the peacock. The fan is spread only during courtship

an apparatus at the terminal part of the abdomen, likewise show no real tail—and so on.

In the back-boned animals or vertebrates the tail appears as a definite structure. Here, in the fish, amphibians, reptiles, birds, and mammals, there is probably no part of the physiognomy that has been subjected to a more interesting series of variations and uses than this appendage.

Photograph by Mary C. Dickerson

WOODPECKERS REST ON THEIR TAILS

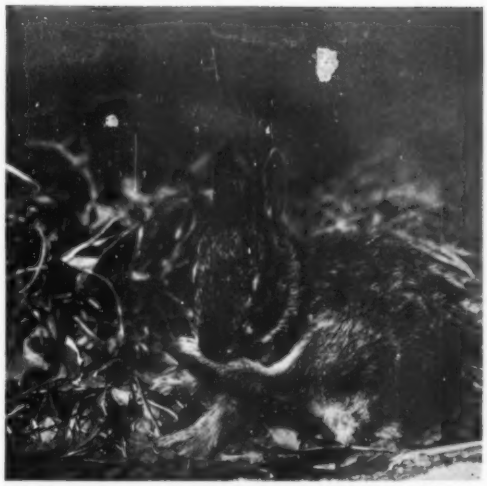
The downy woodpecker hangs to the tree with his claws and props himself with the stiffened spike-like quills of the tail feathers

Take for instance, among the reptiles, a fossil form, the ancient *Ichthyosaurus* or "fish-lizard," was obviously specialized for pelagic life like the porpoise and the whale, but the most primitive modern species, the tuatara of New Zealand (*Sphenodon punctatum*) shows none of this. Its tail is merely strongly compressed along its length, as are those of many other reptiles which live in marshy or semi-aquatic habitats—such as the crocodiles and their allies, or certain large South American lizards of the family Teiidæ (*Dracaena guianensis* and *Crocodilurus lacertinus*). Such tails are long and strong, being obviously adapted to aid in swimming movements and in defense. A similar type of modification is found in the marine snakes which occur so commonly in the vicinity of the islands of the Pacific and Indian oceans. These creatures usually have the elongate body and other general characters of the

serpents, but their tails, instead of being rounded as in the terrestrial species, are often much compressed, so as to form a helpful rudder which may be waved from side to side while the animal swims about.

The tails of the turtles, like those of the horned lizards (*Phrynosoma* and *Moloch*), are almost too small and insignificant, as reptile tails go, to warrant discussion here, being reduced to but a relatively small fraction of the total length—usually less than thirty per cent.

Many reptiles vibrate their tails when disturbed, but none are better equipped by nature to capitalize this tendency than the venomous rattlers, which, unlike most other poisonous snakes, usually warn their would-be victims before attempting to molest them. The snakes of the genus *Coluber*, known generally as the racers, are unusually nervous and will frequently vibrate the tail when disturbed. Exhibiting this same tendency, a small lizard, the common spiny-swift of central Kansas (*Sceloporus undulatus*



Photograph by Mary C. Dickerson

MOLLY COTTONTAIL

This rabbit carries a tuft of snow-white fur on the underside of its tail. The pursuing hunter can trail the rabbit by this white spot until the rabbit squats and hides its tail

Photograph by N. Y. Zoological Society

THE THIRD LEG OF THE TRIPOD

Kangaroos habitually sit on their powerful tails. So supported they can even strike an adversary with their hind legs

Photograph by A. J. Ortenburger

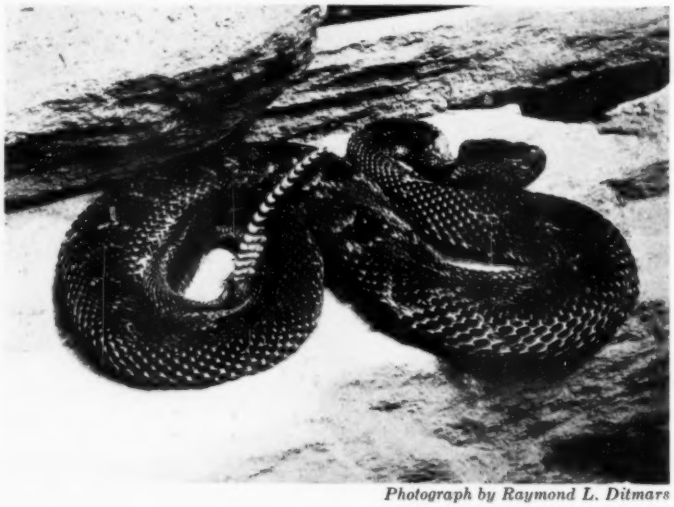
A GILA MONSTER
Our only poisonous lizard, *Heloderma suspectum*, uses its tail as a food reservoir. The tail is rich in fatty tissue and this is absorbed in times of fast

thayerii), reminds one of a pleased dog as it quivers its little tail in anticipation of food.

The Old World chameleons have a prehensile or clinging type of tail somewhat similar to that of the opossum. This is a rather unique development among the reptiles, although it is said also to have taken place in a rare iguanid lizard of the West Indies which is known to scientists as *Xiphocercus valencienni*.

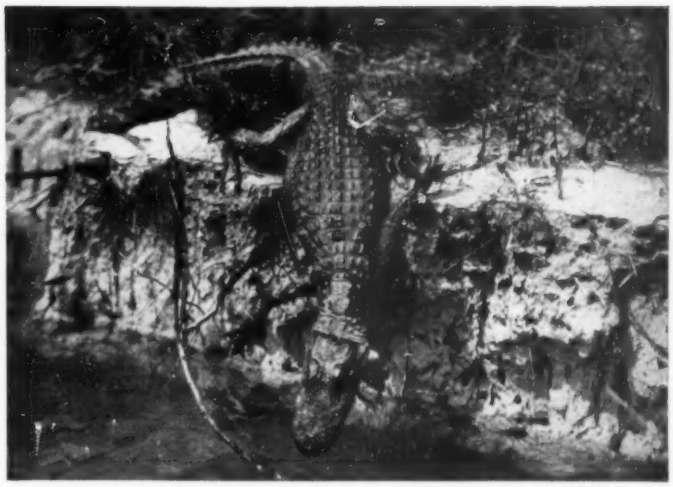
Inhabiting the southwestern United States and the Mexican mainland are the poisonous gila monsters, which have large, rounded tails. These are covered with beadlike scales and are said to act as reservoirs for food, fat being stored in them during times of prosperity and used from them during the periods of inactivity known as hibernation and æstivation.

The tails of many lizards, including those of various geckos, skinks, and "glass-snakes," are very delicate and consequently fragile and easily broken. This feature often spares the life of these animals, for an enemy in pursuit, having succeeded in grasping the tail alone, usually gets a section of just that, and nothing more. If the tail of a skink is injured in any way, so that it starts to come off, the section back of the injury is very apt to be shed whether it is firmly held or not. I have personally observed this phenomenon in the field in the case of an adult Sonoran skink (*Eumeces obsoletus*), which severed its long tail by a series of quick muscular contractions after a slight cut had been made accidentally near the base. After the tail has been broken, the wound heals readily and new or regenerated tissue grows. The part that develops in this



Photograph by Raymond L. Ditmars

THE RATTLE TAIL
At each molt, rattlesnakes fail to shed the tips of their tails, which remain attached to the earlier tips. These tips form the rattle. Rattlesnakes are so deaf they do not hear their own rattle, but its warning sound serves to ward off enemies that might tread on one of these serpents



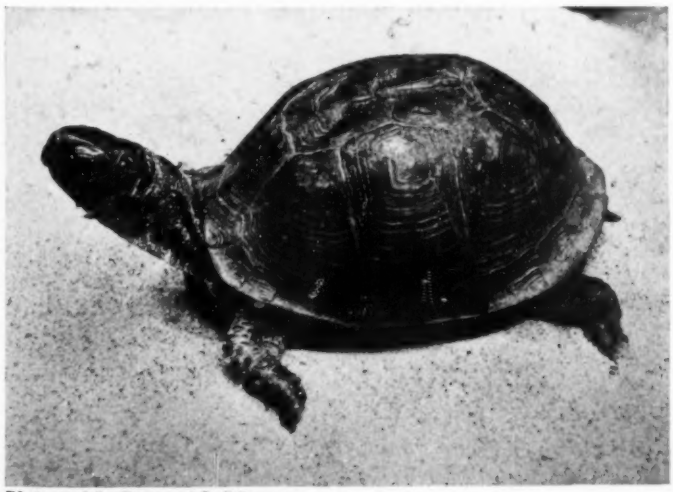
THE ALLIGATOR'S TAIL!
Big alligators have powerful armour-plated tails that are used in swimming and defense. A blow from such a tail could break a man's leg

Photograph by Julian A. Dimock

manner, although not as long as the section lost, often becomes fully as long as or even longer than the remaining stub of the original tail. In many regions various adult skinks and, in fact, certain other lizards, too, nearly all have regenerated or incomplete tails, and middle-sized or even young examples frequently show this state as well. Regeneration often produces freaks, as many scientists have shown, and extra tails are sometimes added after an injury. Two tails are found rather frequently in lizards, but three-tailed examples, although occasionally seen, are decidedly rare.

Amphibians have been divided into three main groups, the tailed and the tailless sections, and the section comprised of the little-known, wormlike cæcilians which we need not consider. The tailed amphibians do not undergo a complete change in outline between the young and adult stages, but are much the same in general appearance throughout their existence, whereas the tailless amphibians, named with reference to the adult anatomy, have a primary or tadpole stage in which the tail is present as in the other group and a secondary or adult stage in which the tail is lost. All degrees of transition between these two extremes may be seen in a carefully selected developmental series of our common frogs and toads. It seems appropriate at this point to call attention to the fact that in certain salamanders, particularly in some plethodontids, the base of the tail is constricted for loss at times of danger, thus serving the same protective purpose as the tails of the lizards mentioned above.

Fishes are specialized for aquatic life and pos-



THE TURTLE'S TAIL
Tails are of little use to slow-moving creatures and most turtles have them reduced to mere stubs. The box turtle endeavors to protect its tail by turning it sideways under its shell

Photograph by Raymond L. Ditmars

Photograph by M. C. Dickerson

THE BULLFROG TADPOLE
In its first stage of metamorphosis into a frog the tadpole possesses a long tail with a finlike border

sess flattened, rudder-like tails that aid in swimming as do similar tails in other groups. The fish-tail, although essentially constant in function and compression, is subjected to numerous variations in detail and outline. Therefore, the structure and appearance of the tail has been deemed of great importance in the classification of the group.

In the birds, the tail is formed internally by a short bony support, the pygostyle, and by the surrounding muscles, and externally by dermal elements, particularly feathers. It is in the feathers that the most obvious and interesting avian variation exists.

Perhaps in no group of animals have the tails become more specialized for purposes of ornamentation or display than in the birds, particularly in the males. In this regard, it is only necessary to mention such striking examples as the lyre bird, the bird of paradise, and the peacock. On the other hand, woodpeckers and chimney-swifts have developed the more practical habit of clinging to vertical surfaces and bracing themselves by means of their tail feathers, which in turn have become stiffened and thereby definitely modified for the purpose.

The wide variations shown by the tails of mammals are thoroughly interesting. For instance monkeys of the New World, belonging to the family *Cebidæ*, nearly all have prehensile or grasping tails, but monkeys of the Old World, curiously enough, have only ordinary, non-prehensile ones, which may, perhaps, be considered decorative, but which perform no useful arboreal or gymnastic duties.

Then, there is the very short tail of the "cottontail" rabbit, which is covered by thick, soft, white, downy fur, as the common name implies, and is conse-

Photograph by M. C. Dickerson

PREPARING FOR THE LAND
In the second stage, the finlike border on the tail is absorbed and the legs assume more important functions

FURTHER METAMORPHOSIS

The bullfrog has now grown serviceable legs and comes out on land. His tail, however, is not yet fully absorbed

Photograph by M. C. Dickerson

quently incapable of any monkey-like uses, but for all that it is still useful enough. Since the back and sides are brownish and much darker in color, this fluffy little ball is very conspicuous when the rabbit is running. Therefore, an enemy in pursuit of "bunny," be it man or beast, usually finds his attention fixed upon the "cottontail" rather than upon the prospective victim as a whole. This frequently results in the rabbit's escape, for when it suddenly ceases its zigzag run and as suddenly squats to hide the tail from view, the pursuer frequently finds himself completely baffled, for with the disappearance of the "white spot" the whole animal seems to disappear.

In contrast to the rabbit's type, the tail of the jumping mouse is sparsely haired and of an inconspicuous color. Moreover, instead of being short, and rounded, it is very elongate, measuring about twice the length of the body.

The flying squirrel has a large, flattened, hairy tail, which serves as a balancer in his soaring jumps from branch to branch and tree to tree, but the opossum has a long, hairless, prehensile tail that could not possibly aid its owner in the same manner. Instead, the opossum often grasps objects by winding its tail about them. This trait appears early in life, for each baby opossum thus clings tightly to "mamma" opossum's tail as she swings it over her back and goes for a quiet evening stroll; while later, in the adult, the entire weight of the body may be easily supported from some convenient limb by this remarkable appendage alone.

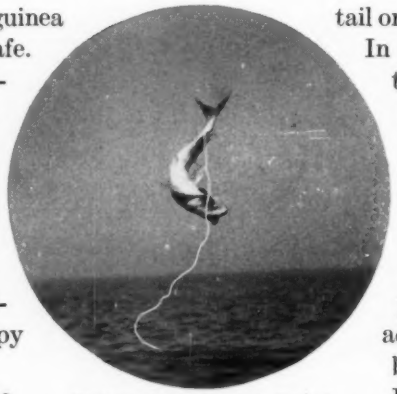
There is an old saying that "if you pick up a guinea pig by the tail, its eyes will drop out." Since the caudal appendage is so short,

Photograph by Herbert Lang

THE SALT MARSH FROG

The adult frog carries no external tail, but backwards from his hump is a true tail bone lying under the skin

being a mere vestige, guinea pig eyes seem perfectly safe. How fortunate it is, however, that the guinea pig does not feel called upon to show its feelings in the same way as does the dog, for it would have to wag the whole end of its body energetically to express a happy emotional state.



Photograph by Julian A. Dimock

THE TARPON JUMPS WITH ITS TAIL

Tails are the chief organs of propulsion in fishes. The tarpon could not leave the water without the aid of the tremendous force exerted by the sculling of its tail

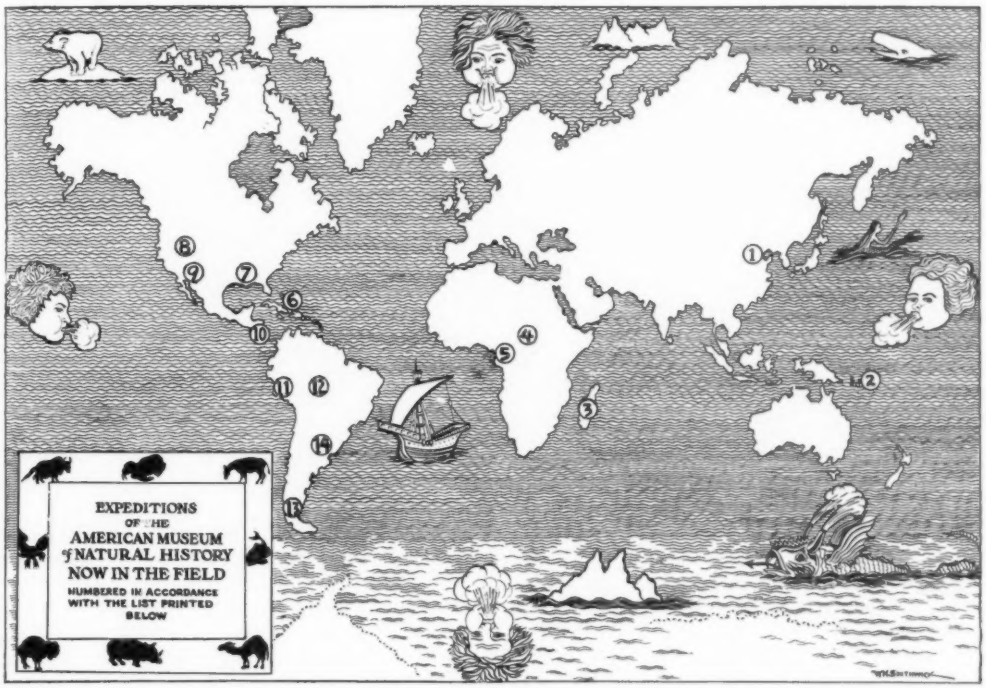
The muskrat and the beaver have much in common, for both of these rodents live in the vicinity of water, both are very fond of vegetable food, and both build more or less elaborate houses or dens for themselves, but when it comes to tails—the resemblances seemingly end. The muskrat's tail is flattened vertically along its length, and while it may serve as a rudder in swimming, it is too weak to be used as a beaver uses his. The beaver's tail, which is flattened crosswise into a broad, paddle-like appendage, has developed an unusually strong set of muscles, so that it may be maneuvered both easily and effectually. This tool is used particularly in swimming and in personal broadcasting when danger threatens. Loud danger signals are often sent out to fellow beavers by a vigorous slap of the alert one's tail on the surface of the water. In remarkable contrast to the types just discussed, the whale and the porpoise have fleshy, bilobed tails, which suggest the fins of fishes but are set cross-wise of the body rather than perpendicular to it. In addition, they lack the bony supporting rays. Like many fishes, both the whale and the porpoise are specialized for life in the open seas.

Again, Nature has been especially generous with the kangaroo, in so far as his tail is concerned, whereas it has decidedly slighted the world's champion heavy-weights, the elephant, the rhincoeros, and the hippopotamus. So strong is the kangaroo's large tail that in times of danger it may support the entire weight of the body while the animal kicks viciously with its hind feet. At other times it is regularly used as a prop in sitting or as a spring or propelling force in locomotion. Exactly contrary to this condition, the elephant's most useful appendage was placed in front of the body instead of behind, while the unlucky hippopotamus was cheated at both ends.

Photograph by J. H. Batty

OPOSSUMS' TAILS ARE SCALY

Even when the opossum feigns sleep, it will usually curl its tail about one's finger if picked up by that appendage. More commonly it serves as a cable by which to hang when gathering persimmons



1. Central Asiatic Expeditions; 2. Whitney, South Sea, Solomon Islands, for birds, mammals, and fossils: 3. Madagascar, for birds, mammals, and fossils; 4. Chapin, Congo, for birds; 5. Columbia University-American Museum, to Africa, for anatomical study; 6. Klingel, West Indies and Central America, for lizard studies; 7. National Zoological Park-American Museum, Georgia, for reptiles and amphibians; Archbold, Georgia, for mammals; 8. Predatory mammal control field investigations; 9. Frick-Rak, Southern California, for fossils; 10. Chapman, Barro Colorado, for bird study; Lutz, Barro Colorado, for insect study; 11. Frick-Blick, Ecuador, for fossils; 12. Ollala Brothers, Brazil, for birds and mammals; 13. Scarritt, Patagonia, for fossil mammals; 14. Naumburg-Kaempfer, Southeastern Brazil, for birds

AMERICAN MUSEUM EXPEDITIONS AND NOTES

EDITED BY A. KATHERINE BERGER

It is the purpose of this department to keep readers of NATURAL HISTORY *informed as to the latest news of the Museum expeditions in the field at the time the magazine goes to press. In many instances, however, the sources of information are so distant that it is not possible to include up-to-date data*

THE COLUMBIA UNIVERSITY–AMERICAN MUSEUM ANATOMICAL EXPEDITION.—Mr. Henry C. Raven, leader of the Columbia University and American Museum Expedition to Equatorial Africa, cables that he intends to sail homeward from the French Cameroun on November 15, with his collections. The departments of anatomy and comparative anatomy of Columbia University and the American Museum are eagerly awaiting his return.

DR. DUDLEY J. MORTON, research associate in comparative and human anatomy, who is associate professor of anatomy at the College of Physicians and Surgeons, will report at the annual meeting of the American Association for the Advancement of Science on some of the human footprints which were collected for him by the Columbia University and American Museum Expedition. Dr. William K. Gregory will give a general account of this expedition at the same meeting.

AFTER several years' study of human prehistory in France and China, Dr. George E. Brewer, research associate in somatic anthropology, has returned to the American Museum.

THE SCARRITT-PATAGONIAN EXPEDITION.—Readers of NATURAL HISTORY will undoubtedly be interested in extracts from a letter received from Dr. George Gaylord Simpson dated September 27, 1930, and mailed from Comodoro Rivadavia, Argentina.

We are just entering the gulf of my patron saint, Golfo San Jorge, on the [Argentine] government oil tanker "Ministro Frers." We were due at Comodoro Rivadavia several hours ago, but won't arrive until tomorrow—thanks to violent winds and generally murky weather for the last two days. The empty tanker has done everything but fly, but for a modern miracle I haven't been seasick. Our car

and all equipment are on board, happily did not carry away although on deck, and in a few days things can really start.

The revolution was quite a good show and I would have enjoyed it thoroughly if I hadn't been so mad at the delay. On the 6th, just before the Government House capitulated, there was a good deal of street fighting as well as plain and fancy murder on the part of the Irigoyenist forces. For instance, I was standing on a street corner with a small group of unarmed civilians when a detachment of the mounted Escuadrón de Seguridad opened fire on us without warning and then charged us. The man next me was killed, but I escaped and found shelter in a clockshop with steel shutters. I left there, only to have to duck again when horsemen began cleaning up Rivadavia Street with sabres. Eventually I got back to the Avenida de Mayo, only to run right into the most bloody engagement of the day when the Plaza de Congress and upper end of the Avenida were swept by machine guns and field artillery. I managed to escape this unscathed and spent about an hour inside a steel-shuttered café, while the battle raged just outside. I got out in time to see the white flag go up on the Casa Rosada (Government House) and the mad rush of the people to sack the building, the triumphant arrival of Generals Uribum and Justo, leaders of the revolution, and the insane joy of the populace, far into the night.

¡Monday an enormous crowd, estimated at 350,000, gathered to hear the new government sworn in at the Plaza de Mayo. Four hours later the plaza, still resplendent with lights and flags, was deserted except for dead and wounded, guerillas creeping along and dodging from doorway to doorway, and ambulances dashing through the line of fire to pick up the casualties. This plaza was cleaned out with machine guns, and on the other side of the Casa Rosada, on the Plaza Colón, field guns shelled the new Post Office and the Custom House. I stuck around here 'till the firing died down, but going home, thinking all the excitement over, I had the scare of my life. Two of the numerous guerillas who were looting and murdering all over the city grabbed me, poked rifles into the pit of my stomach, and started interrogating me in rapid gutter Spanish. They were excited and hard cases and I thought my hour had struck, but I talked, explained, and argued my way out of it. I have never before, and probably never will again, talk such fluent Spanish.

After all this and much more, life seems rather dull now. After the revolution it was chiefly a matter of going the rounds every day, arguing, swearing, and pulling strings until finally things came our way and here I am nearly to Comodoro Rivadavia. It is still pretty cold down here, but warm enough to work, and I need hardly add how keen I am to be up and at it at last.

(Signed) GEORGE GAYLORD SIMPSON

PREDATORY MAMMAL CONTROL.—At the annual meeting of the American Association of Mammals held in May of this year a special committee was appointed to ascertain the facts relating to the control of predatory mammals and to coöperate with the United States Biological Survey in a study of the various problems involved. Mr. George Goodwin and Mr. T. D. Carter left New York late in October to carry on field investigations in this connection.

The control policy of the Survey in the field has involved a very extensive use of poison, and it is the belief of many competent naturalists that such a widespread use of poison threatens the very existence of our predatory mammals. Mr. H. E. Anthony of the American Museum was appointed chairman of this committee and has established relations with the Biological Survey and with other institutions and interests concerned in this crisis.

Mr. Goodwin will travel with a field investigator from the Biological Survey and the party will conduct a joint investigation in the states of Idaho and Utah. The special committee will also have representatives acting jointly with the representatives from the Biological Survey in the states of California, Arizona, New Mexico, Texas, and possibly Nevada and Oregon.

Mr. Carter has a roving commission to interview trappers and raw fur dealers in an effort to learn just how far the fur-bearing mammals are imperiled by present-day methods of control.

The New York Zoological Society is coöperating in this investigation, and is represented jointly with the Museum by Mr. Goodwin. Other institutions which have affiliated themselves with the work of the Commission are the California Fish and Game Commission and the University of Arizona.

THE VERNAY-LANG KALAHARI EXPEDITION.—Early in October Mr. Arthur S. Vernay returned to New York, having brought to a successful conclusion his extensive expedition in Angola and the Kalahari.

This was an undertaking of great importance, and the fact that a party of 14 white men and 16 natives was able to cross the Kalahari, proceed to Ngamiland and thence to Livingstone, a period of three months and a half of travel, without accident or sickness speaks highly of Mr. Vernay's powers of organization and of the efficiency of his personnel. This is the first time that zoological collecting on such a thorough scale has been carried on in this part of Africa, and over part of the itinerary no collecting at all had been done previously.

The expedition started from Gaberones on March 17, 1929, and the work was not completed until the summer of 1930. Mr. Vernay planned the project as a joint expedition for the Field Museum of Natural History, the British Museum of Natural History, and the American Museum of Natural History, and the large collection he brought back will be of the greatest value to these institutions.

The outstanding specimens collected include groups of the following species, some of which are exceedingly rare, blesbok, black wildebeeste, red hartebeeste, gemsbok, lechwe, springbok, steinbok, and sassaby, while among the mammals taken for the study series are such species as giraffe, Burchell's zebra, eland, sable, etc. In addition there are, in round numbers, 500 smaller mammals, 700 birds, 200 fishes, 5,000 insects, and 500 specimens of lower invertebrates.

It is hoped that in a later number of NATURAL HISTORY Mr. Vernay will write an article on the Kalahari Expedition, telling some of the many interesting incidents which must have characterized the field work.

A Study of Race Mixtures in Hawaii.—The Universtiy of Hawaii, aided by a Rockefeller Grant, has undertaken a noteworthy project in the Territory of Hawaii. The unique racial situation in Hawaii, where Europeans, Americans, Chinese, Japanese, Filipinos, and Porto Ricans have invaded within the last century and where these people have mixed with the Hawaiians and each other, offers exceptional opportunities for investigations in the study of race mixtures.

Dr. H. L. Shapiro of the American Museum, which is coöperating with the University of Hawaii, has just returned from a summer spent in Hawaii organizing an investigation of the Chinese-Hawaiian crosses. He was accompanied by Mr. W. A. Lessa, who is assisting him. Doctor Shapiro reports that anthropological, psychological, and sociological studies are under way on this group. Studies in blood grouping and basal metabolism are also in progress.

The Gulf of Guinea Expedition.—During the ornithological collecting of Mr. and Mrs. José G. Correia at Fernando Po, in the Gulf of Guinea, a project supported for the American Museum of Natural History by the late Mr. S. Brinckerhoff Thorne, the field workers received many courtesies from officials of the Spanish Government as well as from civilian residents.

As an expression of appreciation, on his own behalf and that of the American Museum, Mr. Correia presented to the Colonial Government a series of duplicate specimens. These were subsequently forwarded to Madrid and, since the return of Mr. and Mrs. Correia to the United States, the transaction has been noted as follows in the *Boletin Oficial de los Territorios Españoles del Golfo de Guinea* for August 15, 1930:

Royal Order No. 451.

The Director of the National Museum of Natural Sciences, in an official communication, addresses the Government of Morocco and the Colonies as follows:

I have the honor to acknowledge receipt of a collection of birds from Fernando Po, the gift of Don José G. Correia, which the Government forwarded to us on April 5. Because of the scientific value of the species comprised in this collection, and the beautiful preparation of the specimens, the consignment greatly enriches our ornithological material from the Gulf of Guinea region. It seems fitting, therefore, to express appreciation through royal order to the generous donor. In view of this, His Majesty the King has graciously directed that thanks be extended to Don José G. Correia for a gift which has so enriched the collections of the National Museum of Natural Sciences.

By royal command I beg to inform Your Excellency and other interested persons of this action.

God preserve Your Excellency.

Diego Saavedra
Director General.

Madrid, July 10, 1930.

A Fossil Reptile from Arizona.—Mr. Barnum Brown, assisted by Mr. L. I. Price of the Oklahoma University, spent a very successful summer in the Triassic beds of the Little Colorado River, chiefly in the vicinity of Cameron, Arizona.

This expedition went out primarily to secure missing parts of a small reptile discovered in November, 1929, which is considered to be the probable ancestor of dinosaurs and phytosaurs. It is thought that the pieces secured are sufficient for a restoration of this rare creature.

A new fossil horizon was discovered in the Triassic beds, and the geologic data obtained by Mr. Brown indicates a three-fold division of the Triassic in America as it is known in Germany.

Another important discovery near Cameron was an ancient house site where all non-perishable contents were preserved, including vessels of several different designs and decorations, the character of which indicates one of the early ancient Pueblo stages.

An Expedition to the West Indies and Central America.—The yawl "Basilisk," built especially for an American Museum expedition, left Baltimore in October for the southern Bahamas on the first leg of a voyage which it is expected will take a year and a half. The "Basilisk" is almost an exact model of the famous "Spray" in which Captain Joshua Slocum sailed alone around the world in the early '90's.

The expedition, under the leadership of Mr. Gilbert C. Klingel, is planning to study the life-histories of lizards and especially the organization of lizard colonies in the American tropics. Mr. Klingel will be assisted by W. Wallace Coleman, a Baltimore naturalist, and by W. G. Hassler of the Museum staff.

The "Basilisk" is apparently the first vessel ever constructed for a museum expedition. Although only fifty feet over all it is well equipped with a dark room and other aids for laboratory work. The name chosen for it is that of a Central American lizard which exhibits great agility in running over the surface of the water. Further notice of the expedition, which is sponsored by both the Maryland Natural History Society and the American Museum of Natural History, will appear in the next number of Natural History.

Mammals from the South.—Mr. Richard Archbold is spending the autumn in southern Georgia where he is collecting mammals for the American Museum.

NOTES

HARRY PAYNE WHITNEY

IN the death of Mr. Harry Payne Whitney, in his fifty-eighth year, the American Museum has lost a member of its class of Benefactors, and the patron of one of the most extensive scientific projects ever undertaken by the institution.

Mr. Whitney's interest in the American Museum of Natural History may be said, in a sense, to have been inherited from his father, the late William C. Whitney, who for many years supported the researches of President Henry Fairfield Osborn on the evolution of the horse. The son's munificent aid was given more especially to the department of birds, to be devoted particularly to that branch of ornithology concerned with birds of the ocean and with those inhabiting remote islands, such as the far-flung archipelagoes of the Pacific. In the spring of 1920 Mr. Whitney gave funds for field work which has since been uninterrupted, and which has enabled the Museum to maintain a corps of naturalists and a well equipped exploring schooner, the "France." During the course of ten years the field party has worked at more than five hundred islands in the south Pacific Ocean. At present writing the vessel is en route from New Guinea to Ponapé in the Japanese Mandate group.

Such complexes of remote islands represent one of the last great fields for zoological exploration. Mr. Whitney became so much impressed with the discoveries of the Whitney South Sea Expedition and with its opportunities for scientific education, that he recently made possible the construction of a new wing of the Museum designed to house the department of birds, and including special provision for exhibiting the island and oceanic birds of all the world. Plans have also been made in this building for a genetic study of birds in modern, well-equipped laboratories and aviaries.

The first step toward the erection of this new wing of the Museum, to be known as the Whitney Memorial Hall and to face Central Park just north of the Roosevelt Memorial, was Mr. Whitney's gift of $750,000, given on condition that the City of New York contribute an equal amount. The city promptly fulfilled its part of the transaction. The plans were subsequently drawn and construction is about to begin.

To an extraordinary degree Mr. Whitney was interested in the new unit of the Museum, and also in the publications and many-sided researches for which he was in so large a measure responsible. While it is hoped that it may still be possible to carry out all of his cherished plans, it is greatly to be regretted that he might not have lived to see them further advanced.

WILLIAM DILLER MATTHEW

ON September 24, 1930, the many friends of Dr. William Diller Matthew learned with great sorrow that he had succumbed to the serious illness which he had been fighting bravely for several months.

Doctor Matthew was born in St. John, New Brunswick, February 19, 1871, his father's family being descendants of the Royalists who settled there at the time of the American Revolution. His mother was descended from American Revolutionary ancestors. His father, Dr. George F. Matthew, was a well-known palæontologist and geologist, an amateur in the best sense, who amassed a great collection of Palæozoic plants, invertebrates and batrachian footprints from the region of New Brunswick and contributed important papers on these and kindred subjects.

William, the eldest of a large family, early absorbed the spirit and viewpoint of the natural sciences from his father and came as a graduate student to Columbia University with an exceptional endowment in these lines. He studied geology, mineralogy, and metallurgy under Professors Eggleston, Kemp, and Moses; his earlier papers, beginning in 1892, dealt with a crystallographic study of topaz from Japan, the antennæ and other appendages of trilobites, the intrusive and effusive rocks near New Brunswick, and similar topics. All his subsequent work in vertebrate palæontology was based upon this solid training in geology. After taking Professor Osborn's courses in vertebrate zoölogy and palæontology, he obtained his doctorate in 1895 and was called to the American Museum of Natural History as assistant in the department of vertebrate palæontology.

He took a great part in the field and laboratory work of the department, at first under the immediate direction of Dr. J. L. Wortman, later as assistant curator, curator, and finally as curator-in-chief of the division of geology, mineralogy and palæontology. It was most fortunate for the Museum that from the first he displayed a passionate ardor for keeping the records straight. He had an almost religious veneration for every specimen, no matter how small or unimportant in appearance, of the tens of thousands that passed through his hands, not because of sentimentality but because he was constantly seeing the value and meaning even of small fragments which had been carefully recorded as to precise

geologic level and locality. He never wearied of insisting upon the value of facts as compared with theories; he once said that the skeleton of *Phenacodus* was of incomparably greater value than all the hypotheses that had been based upon it.

He took a keen interest in the problems that were constantly being raised in the attempts to mount fossil skeletons in lifelike poses and that were to be solved only by carefully correlated studies on the postures and skeletons of living animals. During the years before 1905, while the skeleton of the huge *Brontosaurus* was being removed from the matrix and restored and mounted by Adam Hermann and his assistants, Doctor Matthew studied the problems involved in the reconstruction and mounting. Before the limbs and girdles were mounted, he and Walter Granger dissected an alligator, marked the areas of origin and insertion of the limb muscles on the girdles and limb bones, and then identified as far as possible the corresponding areas on the bones of the *Brontosaurus;* finally, by means of scale drawings and paper strips representing the muscles, they endeavored to determine the course and direction of the principal muscle masses in so far as they would influence the posture of the limbs and girdles, especially the angulation of the elbows and knees. This was apparently the first application of the data of comparative myology to the mounting of an extinct animal and the studies that Matthew and Granger made at this time led eventually to further developments of these subjects of comparative myology and osteology by other workers in the Museum and elsewhere.

Photograph by Julian P. Scott

WILLIAM DILLER MATTHEW
(1871–1930)

Soon after Doctor Matthew's coming to the American Museum of Natural History in 1895, he was sent by Professor Osborn to Philadelphia to catalogue, pack, and ship to New York the great collections of Prof. E. D. Cope, which had been purchased by the Museum. In this way Matthew came to know and admire Professor Cope and began the detailed task of checking Cope's identifications and revising his classifications, which was to occupy him, along with many other matters, for the next thirty-odd years.

The two hundred and thirty-odd entries in Doctor Matthew's list of scientific publications cover a multitude of topics relating to the evolution of mammals and other vertebrates, as set forth in broadly conceived comparative studies, chiefly on the skeletons of recent and fossil mammals. It may be said in brief that Evolution was the one theme about which he was always writing, whether he was dealing immediately with the description of newly discovered fossils or comparing the fossil faunas of one region with another, or tracing the routes by which races that first appeared in the northern continents found their way south into tropical and southern countries and often survived there long after the other descendants of the original stock had been exterminated in the primal home of the race.

Scrupulous intellectual honesty was one of his outstanding characteristics, and if the evidence had been adverse to the general theory of evolution he would have been the first to have tried and tested it and then to have renounced Evolution as a colossal error. On the contrary, the most intimate and prolonged study of tens of thousands of fossil specimens led him to write the following striking passage:

"Broadly speaking, the evolution of the horse in the sense of a regular progression by gradual

stages from small primitive four-toed ancestors to the large, highly specialized, one-toed horse, appears not as a theory but a fact of record. It is equally a fact of record that the tapir and rhinoceros are derived from the same primitive stock through a similar series of progressive stages. Widely different in appearance and habits today, they have diverged from a common ancestral stock.

"If, therefore, we turn to the record of geologic history to answer the question whether as a matter of fact the diverse types of existing animals did evolve from common primitive stocks, or whether the various races have remained unchanged since they were created, the answer is perfectly definite and categorical. Whenever the evidence is sufficient, as it is in this instance, it proves the theory to be a fact of record. When the evidence is insufficient for proof, it fits in with the evolution theory, so far as it goes. It is in comparatively few instances out of the millions of existing species that the categorical proof of their evolution is at hand. This will always be true, although the number of proofs and the completeness of the evidence grows year by year.

"It is asserted by some opponents of evolution that 'the evidence is all circumstantial.' Probably what they mean is the anatomical evidence —which, moreover, they totally misconceive in saying that it is 'a matter of resemblances.' The fossil evidence, however, is not circumstantial; it is the direct testimony of the record itself, far better than 'eye-witness testimony,' for eye-witnesses may easily be mistaken, and often are, and there is no way to discover and correct their mistakes save the imperfect and uncertain methods of collation and cross-examination. As for the evidence of comparative anatomy, while it is indirect, and may be compared to circumstantial evidence, its weight lies not at all in 'resemblances' but in identity of structural plan underlying a wide *diversity* of appearance and habits. We regard horse and man as related, not because they resemble each other, for they are utterly diverse in appearance, but because in spite of this diversity the anatomist finds that their underlying structure is fundamentally the same."[1]

In the course of his work for the Museum Doctor Matthew took a leading part in many expeditions in the fossil fields of Wyoming, Colorado, New Mexico, South Dakota, Nebraska, Florida, Mongolia, Java, etc. He studied in the principal museums of England and the Continent, in India, China and South America.

[1] "The Evolution of the Horse. A Record and Its Interpretation." Quart. Rev. Biol., Vol. 1, No. 2, April, 1926, p. 176.

Not the least of his services was his long series of illuminating articles in NATURAL HISTORY on palæontological topics and his admirable handbooks and guide leaflets on the Hall of Fossil Mammals, on Dinosaurs, on The Evolution of the Horse, and many others.

In recognition of his distinguished contributions to science he was elected to fellowship in many learned societies both at home and abroad. He served as president of the Society of Mammalogists in 1926 and as president of the Palæontological Society in 1929. He was also a fellow of the Royal Society of England.

In 1927, after thirty-two years of service in the American Museum, he resigned his position as curator in order to take up new duties as professor of palæontology and curator of the Palæontological Museum of the University of California. His courses in palæontology, notwithstanding their difficult character, were attended by many hundreds of students, and he was thus fast realizing his ambition to train a new generation of palæontologists eager to carry on the work of exploration and research.

Undoubtedly his quite untimely death inflicts a severe loss on the cause of science and enlightenment. But he left to the world a huge legacy of organized knowledge; he opened broad fields for further development, and he trained and inspired many others to carry on his work.

—WILLIAM KING GREGORY

ASTRONOMY

MOTION PICTURES OF THE MOON shown by Dr. John Q. Stewart of Princeton and his associate Mr. R. F. Arnott, were the main feature of the meeting of the Amateur Astronomers Association held November 5. These photographs were taken in the observatories at Princeton and Mt. Wilson, and show the sun rising and setting on the craters of the moon. Doctor Stewart also talked on "Some Restrictions on the Application of the Rocket Principle to Interplanetary Travel." On November 11 Dr. Giorgio Abetti, director of the Royal Observatory, Arcetri, Italy, spoke on "Galileo and Astronomy in Florence." This was of particular interest because the Arcetri Observatory was dedicated to the memory of Galileo, who lived his last years in the immediate neighborhood of its site.

On December 3 Dr. Clyde Fisher will give an illustrated talk on "An Astronomer's Rambles in Iceland and Lapland." This is reminiscent of Doctor Fisher's recent trip to these countries.

On December 17 Mr. Wallace J. Eckert of the astronomy department, Columbia University, will discuss "The Orbit of Eros as an Astronomi-

cal Yardstick." This small asteroid, whose diameter is less than the length of Manhattan Island, will approach the earth during this coming winter more nearly than any other body in the planetary system, with the exception of the moon. By means of observations made at this time, astronomers hope to be able to determine more accurately the distances within the solar system.

Radio broadcasting will be resumed by the Amateur Astronomers' Association on Saturday, December 6 from 5:30 to 5:45 P.M. over station W O R and will be conducted weekly at the same time.

BIRDS

TWO NEW BIRD GROUPS were officially opened on the evening of November 6 immediately after a lecture by Dr. Frank M. Chapman to the members of the American Museum on "My Tropical Air Castle." One of the groups, depicting the bird-life of the Higher Andes, shows a view in the Paramo Zone from near Mt. Aconcagua, Argentina. The studies for this group were made by Doctor Chapman and Frederic C. Walcott in February, 1924.

The second group, "Bird Life of the Pampas," is the gift of Mrs. Anna E. Erickson, and is dedicated to the memory of William Henry Hudson, who passed part of his boyhood near Lake Chascomus, a bit of which is reproduced in this group. Of this region Hudson wrote in *Far Away and Long Ago*, and here he laid the scene of his story *El Ombu*. The birds of this faunal group are characteristic species of the South Temperate Zone. The studies and collections for it were also made by Doctor Chapman and Frederic C. Walcott in March, 1924.

RESEARCH IN THE TROPICS.—Dr. Frank M. Chapman will return to the Canal Zone early in December to carry on further studies at the Barro Colorado Biological Station.

CONSERVATION

THE CONSERVATION OF WHALES.—Apropos of the statement of principles and rules submitted in the form of a draft convention to the Economic Committee of the League of Nations, by the representatives of the eight nationalities who met in Berlin last April, A. Brazier Howell in a letter addressed to the members of the Council for the Conservation of Whales says:

> At the June meeting of the Economic Committee of the League it was recommended that this draft convention should be transmitted to the several governments concerned for their consideration and approval. This document (Official No. C.353. M.146, 1930 II., Series of League of Nations publications) has now been received by the State Department of the United States Government.
>
> This "draft convention for the regulation of whaling" submitted to the Council of the League of Nations by its Economic Committee contains such details, previously recommended by your own council, as: (a) total protection of all species of right whales; (b) protection of calves and nursing females; (c) fullest possible use of whale carcases; (d) remuneration of gunners and crews of whaling boats to depend upon size, species, value and yield of oil of whales taken and not merely on number of whales secured; (e) a license or certificate of notification from all vessels engaged in whaling; and (f) the establishment of a statistical organization to collect and distribute statistics on whaling.
>
> The action of the League of Nations in behalf of conservation measures for the maintenance of the supply of whales and the exploitation of the riches of the sea is correlated with the work on codification of international law. The State Department of the United States informed the League of Nations some time since that "an international conference is desirable to consider the problem of conserving the whale." But the present opinion of several governments, including the United States, is now to the effect that this subject requires further international regulation before inclusion in the Codification Conference.
>
> It should now be the purpose of your Council to contribute as much as feasible toward the attainment of such international regulation, especially as concerns the United States.

EDUCATION

ADULT EDUCATION.—The department of public education of the American Museum has inaugurated a lecture series for adults for the fall season of 1930. It is called the "Know Your Museum Series," is limited in number to twenty-five, and is open to Museum members only. As suggested by the title, the course has been planned to give members a comprehensive knowledge of the exhibition halls. A brief background for each subject will be presented preceding the visit to the Hall. The lectures already held have proved most popular.

For December and January the program will be as follows:

December 5, Reptile and Amphibian Hall, Mr. William Carr
December 12, Insect Hall, Mrs. Grace Ramsey
December 19, Geology Hall, Mr. Sydney Heilprin
January 9, Dinosaur Hall and Reptiles of the World, Dr. Charles Mook
January 16, The Hall of the Age of Mammals, Mr. Walter Granger
January 23, The Hall of the Age of Man, Miss Marcelle Roigneau

RESTAURANT SERVICE

FOR THE CONVENIENCE OF AMERICAN MUSEUM MEMBERS and their friends, the American Museum restaurant will remain open from 6 to 8 o'clock on the evenings of the Members' lectures, when a one-dollar dinner will be served.

HONORS

THE DEPARTMENT OF STATE has appointed Dr. Frank M. Chapman a member of the National Council of International Coöperation, which, at the request of the Governing Board of the Pan American Union, has been formed to collaborate with the International American Central Council.

DR. ROBERT CUSHMAN MURPHY, curator of Oceanic birds, has been appointed a contributing editor of the *Geographical Review*, the leading American quarterly in its field. The

staff of contributing editors is made up of about ten geographers, the present list including Professors Robert DeC. Ward, Ellsworth Huntington, Douglas W. Johnson, and Alan G. Ogilvie.

LIBRARY ACCESSIONS

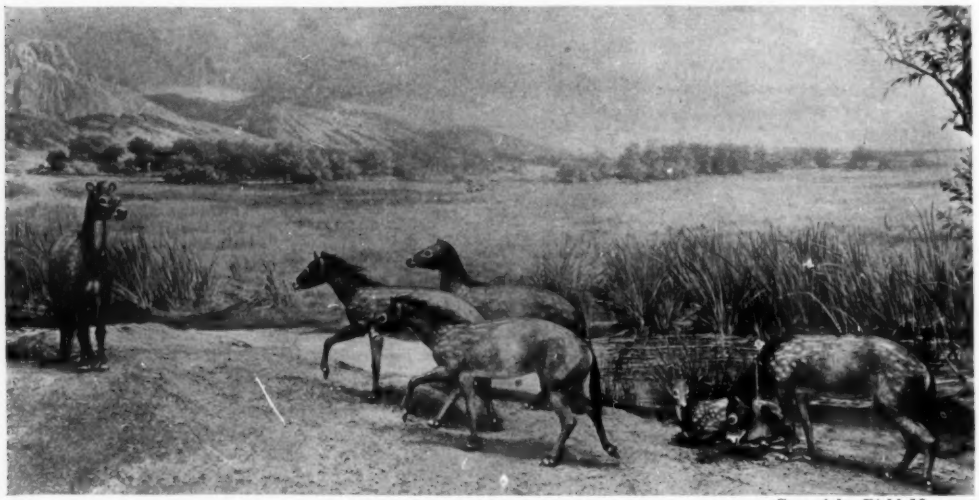
THE AMERICAN MUSEUM LIBRARY has again benefited by the generosity of friends. Captain T. E. Donne, C.M.G., of London, has presented four of his well-known books on New Zealand, *The Maori Past and Present*, *The Game Animals of New Zealand*, *Red Deer Stalking in New Zealand*, *Rod Fishing in New Zealand Waters*, each with a gracious inscription by the author. Mr. William K. Vanderbilt has sent two copies of the "Bulletin of the Vanderbilt Museum," Volume II, constituting a monograph by Lee Boone on the Stomatopoda and Brachyura and forming part of the *Scientific Results of the Cruises of the Yachts 'Eagle' and 'Ara,' 1921–1928, William K. Vanderbilt, Commanding.* In response to urgent requests the Library has for some time been endeavoring to procure a copy of *Histoire Naturelle des Insectes Coleoptères* by Francis L. de Laporte, Le Comte de Castelnau, and takes pleasure in reporting that this rather rare work, in the colored edition, is now on our shelves, thanks to the always helpful efforts of a European dealer. Two copies of Dr. Bruno Oetteking's report on the "Craniology of the North Pacific Coast," forming Volume XI Part I of the *Memoirs of the Jesup North Pacific Expedition*, have also been received.

ASSISTANCE FOR UNEMPLOYED

FOR THE RELIEF OF THE UNEMPLOYED.—In view of the critical situation arising from the unemployment in New York City, the American Museum is coöperating with Mayor Walker's official committee for the relief of unemployment, and has pledged one per cent of the amount of salaries received from the city toward meeting the present emergency.

OTHER MUSEUMS

A NEW IDEA IN EXHIBITION GROUPS.—At the Field Museum of Natural History there is now on exhibition what, so far as is known, is the first group restoration of extinct mammals showing them as they must have in lived North America millions of years ago. This group, a life-size restoration of a species of small three-toed horse, *Mesohippus*, is a gift to the Museum from Ernest R. Graham, a member of the board of trustees, who is sponsoring a comprehensive series depicting scenes and types of life which have existed on the earth as far back as one and one-half million years.



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A NEW GROUP AT THE FIELD MUSEUM, CHICAGO

A new development in group presentation is this life-size restoration of a species of small three-toed horse, *Mesohippus*

The group was designed and modeled by Frederick Blaschke, sculptor, of Cold Spring-on-Hudson, New York, who was responsible also for the Neanderthal man group opened in Graham Hall last year. The models are based upon a comparative study of fossil skeletons of this animal, in relation to the anatomy of modern animals. They have been faithfully prepared after profound study and consultation with a number of leading authorities on extinct animals.

This is the first time that an attempt has been made to restore extinct animals with the hair superimposed on the model. Mr. Blaschke secured the skin and hair of white horses and appropriately gave it the color he desired, also the characteristic whorls or folding of the skin.

The painted background, a reproduction of a scene in the Black Hills of South Dakota where these animals were fairly common in their day, is the work of Charles A. Corwin, Museum staff artist. Messrs. Blaschke and Corwin had the scientific advice and supervision of the curator and other members of the staff of the department of geology of Field Museum during creation of the group.

Valuable assistance and coöperation were also given by Prof. Henry Fairfield Osborn, president of the American Museum, and the late Prof. William Diller Matthew.

RADIO BROADCASTING

AMERICAN MUSEUM BROADCASTING.—Every Sunday afternoon at 3:45 during the winter months a member of the American Museum scientific staff is giving a talk on a natural history subject over Station WOR. On the first Sunday of each month the New York *Herald-Tribune* gives a full-page spread in its rotogravure section correlated with the talk of that day.

SCIENCE OF MAN

TECHNIQUES AND ART FORMS OF THE OMAHA INDIANS.—Dr. Margaret Mead has just brought back a small representative collection from the Omaha Indians in Nebraska. The most interesting aspect of this collection is the variety of techniques and art forms that are known to the Omaha. It includes the traditional porcupine quillwork used by the American Indian before the importation of beads, but these pieces of porcupine quillwork are decorated with fringes made from small squares of tin beaten into cylindrical form and tufted with dyed chicken feathers. There is also a vest of hide embroidered in porcupine quillwork with designs of flags and horses, both contributions from the white man.

The Omaha Indians replaced their porcupine quillwork with ribbon work more than with beadwork. The collection includes cradle-board bands and bands of ribbon work appliqué used on the borders of broadcloth dancing robes. This ribbon work, although the designs are largely suggestive of patterns formerly in use by the Eastern Woodlands Indians, also suggests the influence of ecclesiastical vestments.

The Omaha have always traded extensively with the Siouan tribes, and the collection includes parfleches, a buffalo skin shirt and tobacco pouch obtained from the Sioux more than a generation ago and carefully cherished by the Omaha.

There is also a representative series of moccasins ranging from the typical black moccasin of the old Omaha to modern forms made from buckskin purchased in the city stores, embroidered with modern glass beads and dyed with yellow ocher purchased from the drug-store.

About twenty-five years ago the department of anthropology made a survey of the bead and quill art of the whole area west of the Mississippi. The resulting collections form the exhibit now in our halls of which so much use is made by students of design. Collections similar to this one from the Omaha, made twenty-five years after, are of special interest in showing the historical development of this aboriginal art under modern conditions.

RECONNAISSANCE OF EUROPEAN ANTHROPOLOGICAL MUSEUMS.—Curator and Mrs. N. C. Nelson, of the anthropology department of the American Museum returned early in October from a lengthy vacation trip to Europe. This journey involved two unusually long ocean voyages, one of them by way of Iceland and the two together occupying no less than thirty-one days' residence on shipboard.

Aside from occasional pleasure excursions in different places and visits to a number of famous one-time royal palaces and castles, most of Mr. Nelson's time was spent in museums of distinctly anthropological character. Such museums were visited, for example, at Reykjavik, in Iceland; Trondjem, Bergen, Lillehammer (outdoor museum), and Oslo, in Norway; Göteborg and Stockholm, in Sweden; Copenhagen, Lyngby (outdoor museum), and Kolding, in Denmark; Berlin and Hamburg, in Germany; Brunn and Prague, in Czechoslovakia; and, finally, Vienna, in Austria. Several other cities, like Dresden and Munich, both the possessors of famous museums, were passed through, but were not actually visited for lack of time.

The purpose of these visits was threefold; to see, primarily, what sort of archæological material was being recovered in the different localities, to observe exhibition methods in vogue, and to learn to what extent it was possible to obtain typical specimens, by purchase or otherwise, with which to fill out gaps in the American Museum exhibition series. Mr. Nelson also inspected a number of private collections offered for sale, but found none suitable for acquisition. The best he could do—it being the time of year when nearly every responsible museum man was away on vacation—was to make preliminary arrangements

for a number of possible exchanges. Incidentally, two famous Paleolithic sites were visited in Czechoslovakia, where excavation was observed in progress.

The general impression retained by Mr. Nelson of European museums is both favorable and unfavorable. He thinks that as far as building facilities are concerned Europe as a whole is at a disadvantage as compared with America, in that too often valuable collections are either housed in castles and other old buildings not adapted for exhibition purposes, or they are displayed in modern structures with gorgeously finished palace-like interiors that positively detract from the specimens one wishes to see. There are, however, several exceptions to these extremes.

When it comes to organization and standards of work, Europeans are obviously far and away ahead of us, at least in matters archæological. Thus, in some countries research is so thoroughly planned that they have separate expert curators and field workers for every outstanding culture stage from the earliest beginnings to the present time—Old Stone, New Stone, Bronze, Iron, Medieval, and Modern. The result is conspicuously reflected in instructive exhibits, which are arranged chronologically in a succession of small halls, covering the whole history of local culture so far as known.

ALBERT GÜNTHER

THE CENTENARY OF ALBERT GÜNTHER.—October 3, 1930, marked the centenary of the birth of the great ichthyologist Albert Günther (1830–1914). To commemorate the event, the *Annals and Magazine of Natural History* (London) published a complete bibliography of his writings, with a list of his degrees, honors, etc., in a special number of the magazine.

The bibliography reveals Günther's amazing scientific productivity. He published more than 600 papers, and 15 complete volumes, on fishes, reptiles, and other vertebrates; besides several guide and other museum books, and numerous reports as the Keeper of Zoology at the British Museum.

Günther's most important work is the great *Catalogue of the Fishes in the British Museum*, eight volumes. Although now in large part superseded by later works, it is still a basic reference work in ichthyology. Another noted book of his is the splendid quarto volume on the deep-sea fishes of the famous "Challenger" Expedition. This work gave the world the first extended account of the strange fish life in the great depths of the ocean. He also published a noteworthy popular book on fishes.

It was from the writings of Günther that Charles Darwin derived most of those curious or little-known facts about fishes cited in the *Origin of Species* and his other books on evolution.

—L. HUSSAKOF.

MEETINGS OF SOCIETIES

THE AMERICAN ORNITHOLOGISTS UNION held its annual meeting at Salem, October 20–24. Members of the bird department of the American Museum read papers on the following subjects:

"The Boreal Element in the West Indian Avifauna," "The Turkey Buzzard's Sense of Smell," by Frank M. Chapman.

"Conditions Controlling the Distribution of Sea-birds on the Pacific Coast of South America," by Robert Cushman Murphy.

"Field Notes from Peru," by John T. Zimmer.

NEW PUBLICATIONS

The Book of Bird Life: A Study of Birds in their Haunt; with Photographs by the Author. By Arthur A. Allen, Professor of Ornithology at Cornell University. D. Van Nostrand Company, Inc. New York. 8vo; xix+426 pp.; 275 ills.

For years Doctor Allen, as editor of the school department of *Bird Lore*, has been contributing to that magazine a series of articles based on his wide experience as a student and teacher. Many of these with others before unpublished compose this volume. The method of treatment is subjective. His theme is the significance of things seen. We have not, therefore, a compilation of detached observations but a group of highly suggestive and interesting essays on, for example, Migration, Courtship, Adaptations, Color, Relations to Man, with practical suggestions for attracting, observing, and photographing birds. The book thus appeals to the special student as well as to the general reader. We know of no one better equipped to claim the attention of both than Doctor Allen. A born naturalist, a trained biologist, a keen, discriminating, and patient field student, a pleasing and effective writer, and a skilful photographer, he has used all his exceptional gifts and attainments in preparing these studies.—F. M. C.

The Mound Builders. A reconstruction of the life of a prehistoric American race, through exploration and interpretation of their earth mounds, their burials, and their cultural remains. By Henry Clyde Shetrone, Director and Archæologist, the Ohio State Archæological and Historical Society. D. Appleton and Company, New York and London, 1930.

A good book on the Mound Builders has been wanting until now. Perhaps it had better be said that such a book could not have been written sooner, but certain it is, that the only person to write such a book is the author of this volume. Shetrone, following in the footsteps of the original leader in this field, William C. Mills,

has greatly advanced the archæological technique until his achievements are looked upon as the last word on the subject. Shetrone does not dig a mound, he dissects it as carefully and intelligently as a surgeon approaches a complicated internal situation. The reader of the volume before us soon comes to feel the presence of a master hand, when shown how internal wooden structures of mounds, long since decayed, can be traced in the earth, or how one can see the outline of each human load of dirt dumped into the growing pile. Thus, if the reader turns to page 191 he can see a splendid instance of what fine technique will reveal: one of the dirt carriers building the mound did not dump the load, but, for some reason, threw in container and all. It was a basket which, though decayed, left its imprint upon the load, revealing the pattern of the weave. The load weighed about thirty pounds. What can be more moving than to stand before such long-buried concrete evidence of human behavior.

Even from the first, almost every American was interested in mounds. When our Colonial forefathers crossed the Alleghanies and began to clear away the forests of the Ohio country, they discovered that, long before, other mysterious pioneers had come and gone, evidently also clearing farms in the forest, building up a well-organized society, but eventually passing into oblivion, giving the forest a chance to reassert itself. There was no doubt on the part of these Colonial pioneers that mounds were the work of men, for the finding of burials in them "dispelled any tendency toward belief that they might be of natural orgin. Here, then, was romance and mystery indeed." From the first, the author shows, there were two rival theories to account for the Mound Builders, one that they were a race far superior to the Indians who came after them, the other that they were but Indians of a slightly different culture. Of these theories, the latter now has the widest possible acceptance; but, as the author states, it is not fair to say that these Mound Builders were mere crude savage Indians, for they once supported a culture commanding respect. Yet, though the author is interested in putting forward the evidence for the present scientific conclusions, his chief concern is to take the reader upon an excursion in the mound area, show him the inside of the mounds as well as the outside, let him see the handiwork of the Mound Builders, and help him reconstruct their daily life. To this end the three hundred illustrations contribute. The skill of the author appears just as clearly in the selection of these illustrations as in the handling of the text; each picture makes a point.

The plan of the book is good, treating the Ohio mound area in full and from this as a point of regard reviewing the Great Lakes area, the Upper and Lower Mississippi areas, as well as certain marginal areas, like the Tennessee-Cumberland and Pennsylvania areas. In the final summary the author commits himself to the idea that the Mound Builders migrated from Mexico after the initial development of Middle American civilizations. Upon this point there is less agreement among the experts, nor do the data presented make the case more probable than before. The general reader, however, need not be troubled over this.

Finally, the book presents data upon some of the recent finds in mound exploration, for instance, the astonishing examples of sculpture in stone from the Tremper Mound, almost the last word in realistic figurines of animals and birds. These objects promise to hold their place as the masterpieces of prehistoric North American art.—CLARK WISSLER.

Animal Life of Yellowstone National Park. By Vernon Bailey, Chief Naturalist, United States Biological Survey. 1930. Pp. 241. Charles C. Thomas, Springfield, Ill.

MR. BAILEY has written another splendid book on our native animals. Since it is both entertainingly written and authoritative, it is an ideal handbook for the region that it covers.

The volume consists essentially of an account of every mammal and many of the birds known to occur in Yellowstone National Park. The best known of these are, of course, treated the most adequately. For almost each species there is a resume of its distribution, migration movements, its abundance past and present, relations to other animals, and of course information concerning food habits and general mode of life.

In the sportsman's world there is a strong tendency to classify every animal under one of the two headings of *game* or *vermin*. Those in the *game* list are of course to be encouraged, but those species which do not interest the sportsman or which perhaps live to some extent at the expense of game populations are treated as enemies. It is regrettable to see so sympathetic a student of animal habits as Mr. Bailey take one side. He remarks, for example, that wolves and game cannot successfully be maintained on the same range. He seems to believe that wolves are none too few in the Park. In 1926 one was seen and tracks of a few others. No more recent records are known. Yet there are some 35,000 elk in this region, and this reviewer, for one, would like to feel that there was a wolf for each thousand head of elk. Just why preference should be shown to "game" animals inside the Park is not clear,

when no animal is supposed to be hunted in the area. To many persons it is far more thrilling to see a wolf, a mountain lion, or even a coyote, than it is to see an elk or deer.

The lions are, according to Mr. Bailey, no longer a serious menace to the elk. With this we can agree, since the cougar is so scarce that those intent upon killing them have not been able to get one since 1924.

The coyotes are here recognized as largely beneficial, though the few young of the great herds of elk are grudged them. Mr. Bailey has chosen for illustration two photographs of coyotes hunting mice, which is certainly a typical occupation. Though some two hundred individuals are killed in the Park every year, the species fortunately seems to hold its own.

No comment is made upon the recently altered boundaries of the Park. Probably about as much has been gained as lost in the changes made, yet there is at this time great danger that a large section along the southern boundary may be sacrificed to lumber interests—at serious cost to the animal life and forests, embracing as this section does one of the chief autumnal migration routes of the larger mammals. If boundaries are to be changed we should extend them outward. Only thus can we adequately protect the mammals.

Mr. Bailey's book should do much to stimulate public interest in our native animals, an interest let us hope that will develop into recognition of our responsibility to conserve our wild animal life, great and small, with prejudice toward none.

—ROBERT T. HATT.

MIGRATIONS OF THE COD.—A recent 136-page document published by the United States Bureau of Fisheries on "Migrations and other Phases in the Life History of the Cod off Southern New England," by William C. Schroeder, forms an important contribution to our knowledge of fish migration. It is based primarily on the recapture of tagged fish, correlated with much other statistical information.

Nantucket shoals is an important cod ground, whence, each fall, large numbers of these fish move southwestward along the coast into waters inhabited by the species only in the colder months of the year, and from where some at least return to spend the ensuing summer on the shoals. The same individual cod may remain there for two or three years, or, if some of them winter to the westward, they may be found on the shoals for several successive summers.

The stock of cod on Nantucket shoals is kept up chiefly by young adult and nearly adult fish which immigrate from other regions, appearing in the fall, and by the year following their first appearance forming a dominating group there. During certain summers a smaller number of fish than go westward in fall move eastward off the shoals into deeper water. This seems to be a true emigration of relatively large individuals to waters more favorable for large fish.—J. T. N.

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SIXTY years of public and scientific service have won for the American Museum of Natural History a position of recognized importance in the educational and scientific life of the nation and in the progress of civilization throughout the world. With every passing year the influence of the Museum widens, as is witnessed by the increasing number of visitors who daily enter its halls without the payment of any admission fee whatever.

THE NEW SCHOOL SERVICE BUILDING, with the increased facilities it offers, makes it possible to augment greatly the Museum's work not only in New York City schools but also throughout the country. About thirteen million contacts were made during 1929 with boys and girls in the public schools of New York and the vicinity alone. Inquiries from all over the United States, and even from many foreign countries, are constantly coming to the School Service Department. Information is supplied to, and thousands of lantern slides are prepared at cost for distant educational institutions, and the American Museum, because of this and other phases of its work, can properly be considered not a local, but a national—even an international—institution. Through its loan collections, or "traveling museums," which are circulated locally, 557 schools were reached last year, and 1,857,729 direct contacts were made with the pupils. More than a million lantern slides were lent to the New York City schools, and 4,297 reels of the Museum's motion pictures were shown in 271 public schools and other educational institutions in Greater New York, reaching 1,725,865 children.

COLLEGE AND UNIVERSITY SERVICE. The President and the Curator of Public Education have extended and intensified the courses of college and university instruction. Among the institutions with which the Museum is coöperating are Columbia University, New York University, College of the City of New York, Hunter College, Rutgers College, University of Vermont, Lafayette College, and Yale University.

LECTURE COURSES, some exclusively for members of the Museum and their children, and others for schools, colleges, and the general public, are delivered both at the Museum and at outside educational institutions.

THE LIBRARY is available for those interested in scientific research or study on natural history subjects. It contains 115,000 volumes, and for the accommodation of those who wish to use this storehouse of knowledge, an attractive reading room is provided.

MANY POPULAR PUBLICATIONS, as well as scientific ones, come from the Museum Press, which is housed within the Museum itself. In addition to NATURAL HISTORY, the journal of the Museum, the popular publications include many handbooks, which deal with subjects illustrated by the collections, and guide leaflets, which describe individual exhibits or series of exhibits that are of especial interest or importance. These are all available at purely nominal cost to anyone who cares for them.

THE SCIENTIFIC PUBLICATIONS of the Museum, based on its explorations and the study of its collections, comprise the *Memoirs*, devoted to monographs requiring large or fine illustrations and exhaustive treatment; the *Bulletin*, issued in octavo form since 1881, dealing with the scientific activities of the departments, aside from anthropology; the *Anthropological Papers*, which record the work of the department of anthropology; and *Novitates*, which are devoted to the publication of preliminary scientific announcements, descriptions of new forms, and similar matters. The Librarian of the Museum, who may be addressed in care of the Museum, may be called upon for detailed lists of both the popular and the scientific publications with their prices.

EXPEDITIONS from the American Museum are constantly in the field, gathering information in many odd corners of the world. During 1929 thirty expeditions visited scores of different spots in North, South, and Central America, Europe, Asia, Africa, and Polynesia, and nearly as many are now in the field continuing last year's work or beginning new studies.

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